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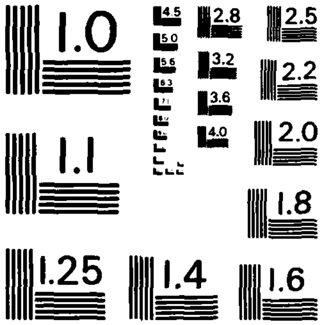

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Project Report Number 2
CULTURAL RESOURCES INVESTIGATIONS FOR
LIBBY RESERVOIR, LINCOLN COUNTY, NORTHWEST MONTANA

VOLUME I
ENVIRONMENT, ARCHAEOLOGY, AND LAND USE PATTERNS IN THE MIDDLE KOOTENAI RIVER VALLEY

edited by
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with contributions by:
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Center for Northwest Anthropology
Washington State University
Pullman

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This report describes the results of an intensive archeological survey of 27.2 mi^2 (70.5 km^2) within and adjacent to the drawdown zone of Lake Koocanusa (Libby Dam Reservoir) in northwestern Montana. A total of 249 sites and 46 isolated finds representing at least 8,000 years were inventoried. Recovered materials include over 32,000 flaked lithic tools, 4,300 faunal remains, and 600 Euroamerican artifacts. These finds are described in the context of late Pleistocene/Holocene geomorphology and geochronology. In addition, the finds are interpreted within a research framework constructed from the

Montane coniferous forest ecosystem and a knowledge of hunter-gatherer adaptations in forested environments. The discussion is supported by detaile analyses of faunal, lithic and radiocarbon material, and concludes with an evaluation of site significance and management recommendations.

Project Report Number 2

CULTURAL RESOURCES INVESTIGATIONS FOR LIBBY RESERVOIR, NORTHWEST MONTANA

Volume 1

ENVIRONMENT, ARCHAEOLOGY, AND LAND USE PATTERNS IN THE MIDDLE KOOTENAI RIVER VALLEY

Edited by

Alston V. Thoms

With Contributions by:

Randall F. Schalk
Robert R. Mierendorf
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Marilyn Bailey
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Report Submitted to:

Seattle District, US Army Corps of Engineers
Under Contract No. DACW67-81-C-0100
and DACW67-83-M-0522

Center for Northwest Anthropology

Washington State University
Pullman

1984

The 1981-1982 archaeological survey and testing project for Libby Reservoir was undertaken for the Seattle District, US Army Corps of Engineers in fullfillment of contract numbers DACW67-81-C0100 and DACW67-83-M-0522. All contract information is filled at the Center for Northwest Anthropology (formally the Laboratory of Archaeology and History), Washington State University, Pullman, under coding 145-01-11F-4970-0022, 145-01-11F-4970-0035, 145-01-11F-4971-0004, and 145-01-11F-4971-0011.

Project Reports is a selected series disclosing the results of research in the form of final and interim reports submitted to agencies which have contracted with the Center for Northwest Anthropology, (formerly the Laboratory of Archaeology and History) for information on cultural resources.

ACKNOWLEDGMENTS

The Washington State University, Libby Archaeological Project (WSULAP) lasted from the late winter/early spring of 1981 into the late fall of 1984 and during that time many people and organizations experienced it. Although the sponsoring agency--US Army Corps of Engineers, Seattle District--presided throughout the project, the organization that implemented it changed its name in mid-stream, from the Laboratory of Archaeology and History to the Center for Northwest Anthropology (CNA). Mr. David Munsell was the Corps' Contracting Officer's Authorized Representative (COAR) through mid 1981, and Dr. David Rice served in that position from mid 1981 to late 1984.

Dr. Randall F. Schalk was the project's Principal Investigator through the summer of 1983. Not only did he formulate the overall research design and generate the land use model as the project's primary focal point, but he continued to write and to stimulate and encourage the other authors long after he became Director of the Office of Public Archaeology (University of Washington) in mid 1983. In all ways Randall performed above and beyond what was expected of a PI.

Dr. William D. Lipe, CNA's Director, became the Principal Investigator for WSULAP in mid 1983. Bill also provided a great deal of support, not the least of which was to convince Dean DeFleur (WSU, College of Sciences and Arts) to provide supplemental funding for final analyses and report production. Dr. Kenneth C. Reid (CNA's Assistant Director) inherited the administrative burden of the project in early 1984. This included the thankless task of winding down WSULAP and functioning as its de facto PI from June through October of 1984, when Bill was on sabbatical. Ken also was instrumental in convincing the administration to provide funding to publish additional copies of this report. The authors are indebted to WSU and to these individuals for their willingness to work toward the dissemination of information beyond that minimally required to meet the terms of the contract.

The entire WSULAP team is grateful for the hospitality shown them by the citizenries of Libby and Eureka, Montana and vinicity. Our special thanks are extended to Ernie Moon and his staff at the Libby Dam, Corps of Engineers Office. We are particularly indebted to Mr. John Davidson who assisted us in solving many problems; he has done much to promote the preservation of cultural resources in the Libby area. We also extend our appreciation to the Forest Service personnel at the Rexford and Canoe Gulch District offices and at the Kootenai Forest Office. Mary Collins, of the Kootenai Forest Office, was especially helpful in providing environmental and cultural resources data for the Kootenai National Forest. The staff of the Lincoln County Archives in Libby was especially helpful in our efforts to conduct deed searches. These individuals and their agencies made our jobs and our stay in the area much more enjoyable.

Survey projects need access to site forms for previously documented cultural resources and to site numbers to be used when recording new sites. These, as well as other information needs, were supplied by personnel at the Department of Anthropology, University of Montana. Dr. Dee Taylor and Douglas Melton deserve special mention for their patience and cordial attitudes in helping us to resolve our site form problems.

Many individuals discussed regional archaeology and shared their ideas with us. Among those who merit a special thanks were Wayne Choquette, Allan H. Smith, Tom Roll, David Rice, and David Munsell. Lewis R. Binford visited our project and shared with us his knowledge of hunters and gatherers and the kinds of sites they leave on the landscape. Our conversations with these people made WSULAP a better project.

We also wish to acknowledge the support provided by Charles R. Knowles and Franklin F. Foit, Jr. for microprobe and optical analyses of volcanic ash samples, by R. H. King of the University of Western Ontario for providing a sample of Bridge River volcanic ash, by Robert Searing for sharing his knowledge of Quaternary geology in the Kootenai Valley, by Stephen W. Barrett for sharing information about the cultural ecology of fire history, by Dr. Richard N. Mack for providing information on the region's vegetation history, and by Bruce Cochran for the glass shard analysis of sediments from several archaeological sites. Information provided by these individuals allowed us to better understand the nature of the Middle Kootenai valley.

Those of us who wrote this report wish to express our appreciation to each other for the many hours of stimulating conversation and to the WSULAP team as a working unit. The team was a multicomponent unit, with a 1981 field/lab crew, a 1982 field/lab crew, and a 1983/1984 analysis and report production crew. Its members and their roles were as follows:

Eileen Adams, draftsperson
Jennifer Ayers, field crew
Marilyn Bailey, assistant lab director
Andrew Barsotti, field/lab crew
Sheila Bobalik, crew chief
Margaret Burke, field secretary
Meg Burns, photographer
Bruce Cochran, geomorphologist
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Kathryn Cox, typist
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Charles Hodges, field crew
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Kenneth C. Reid, de facto principal investigator
Stephan Samuels, computer specialist
Randall Schalk, principal investigator
Steve Shelley, field crew
Alan Stanfill, crew chief
Pamela Stevenson, field crew
Alston Thoms, project director
Marc Varien, field crew
Miranda Warburton, lithic specialist

The team, especially the field and lab crew, endured long hours, wet and cold hands and feet, and the supervisors' haranguing, yet they performed admirably, well beyond that called for by their monetary compensation.

Editorial assistance was provided by Kenneth C. Reid, Robert R. Mierendorf, Deborah Olson, Lorna Elliott, and Kathleen Henry. David Rice, the COAR, reviewed and commented on a draft version of the report. Artifact illustrations were drawn by Chuan-Kun Ho who, along with Todd Metzger and Eileen Adams, also drafted site maps and other illustrations. Artifact photographs were taken by Meg Burns. Lorna Elliott, Dolores Lehn, and Kathline Cox typed the draft and final versions of this report. Sheila Bobalik, Laurel Grove, and Lynne MacDonald prepared draft descriptions (Chapter 11) of the sites they tested in 1982. Miranda Warburton wrote draft descriptions for most artifact classes in the morphological/technological analysis (Appendix D) and Bruce Cochran prepared a draft version of the volcanic ash and glass shard descriptions (Chapter 7). The contributions made by these individuals are acknowledged gratefully and appreciated.

It should be clear by now that many people, some of whom inadvertently remain unnamed, contributed to this report, and to them our gratitude is extended. Nonetheless, the editor and authors, together with the Principal Investigator, bear the responsibility for the report's contents.

ABSTRACT

This report documents a 1981-1984 archaeological project along the middle Kootenai River valley in northwestern Montana. Investigations were sponsored by the US Army Corps of Engineers and designed to inventory and evaluate cultural resources within and adjacent to the drawdown zone of Lake Koocanusa (Libby Reservoir, Lincoln County). Field investigations involved intensive pedestrian survey, surface collecting, and test excavating, as well as mapping geological and cultural deposits. Many small, low visibility, aboriginal campsites were found on the surface of the devegetated drawdown zone, hundreds of feet above the river channel. Those kinds of resources are seldom discovered during surveys in densely forested regions, yet they probably represent the bulk of the archaeological record for montane hunting groups.

A total of 249 sites and 46 isolated artifact finds were inventoried. Recovered materials include over 32,000 flaked lithic artifacts, some 4,300 faunal remains, and more than 600 Euroamerican artifacts. Historic resources include twentieth and late nineteenth century logging camps, farmsteads, and trash dumps, as well as mid-nineteenth century Native American camps. Prehistoric resources, including high and low diversity artifact scatters, fire-cracked rock/bone and fire-cracked rock-only sites, were found in many settings, but most occurred as part of large site clusters on middle and high terraces with southern solar exposures. Cultural and geological chronologies were based on cross-dated artifact types, stratigraphic contexts, relationships to dated volcanic ash deposits, and several radiocarbon dates.

Human use of the landscape probably began at least 8,000-9,000 years ago, before the Kootenai River completed its downcutting through glacial-age deposits. By about 6,000 years ago small groups of people were utilizing the montane coniferous environment on a regular basis. Available data indicate that early Middle Period land use patterns included, winter occupation of the valley, high residential mobility, and reliance on valley wall resources, primarily large game animals. Late Middle Period land use patterns probably involved some summer season occupation, decreased residential mobility, and utilization of valley bottom and valley wall resources. Year-round use of the valley by larger groups of people is considered most characteristic of the Late Period. A higher percentage of residential sites are near major water courses and fishing and plant processing are better represented than during previous periods. Historic, Native American sites, probably occupied by Kutenai Indians, are best represented in areas with sufficient pasture for horses.

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report, entitled Kutenai Indian Settlement and Subsistence Patterns (Smith 1984), focuses on the Upper Kutenai division, thereby facilitating comparison between the ethnographic and archaeological records for the study area.

The remainder of this report concerns the documentation, analysis and interpretation of cultural resources within and adjacent to Libby Reservoir. First, background information is presented concerning previous cultural resources investigations (Chapter 2), and the past and present environmental conditions in the study area (Chapter 3). Next, the project's research design and investigative strategies are discussed (Chapters 4 and 5). General results of the investigations are presented in Chapter 6. Results of geological, lithic artifact, faunal, and site analyses are found in Chapters 7 through 11. Chapter 12 is a discussion of culture history and changing land use patterns in the project area. Chapters 13 and 14 are devoted to discussions of the research value of the resulting data base and the need for further studies. The concluding chapter summarizes the overall results of the project. Appendices to the report include inventory lists for site locations and contents as well as descriptive data for faunal remains, radiocarbon dates, and individual artifacts.

Due to the absence of spatially concentrated, seasonally abundant food resources (e.g., anadromous fish, camas roots, etc.), it is expected that all pre-horse human populations were relatively mobile hunters. Archaeological evidence for shifts in land use between the Middle and Late Prehistoric periods suggests possible changes in the nature and degree of human mobility patterns.

Another research problem stems from the equestrian basis for historic Kutenai land use and mobility, which may bear little resemblance to patterns of land use of pre-horse populations in the region. Consideration of this idea involves comparison of archaeological survey data with ethnohistoric and ethnographic records.

Fieldwork for the project was implemented during the spring seasons of 1981 and 1982. Analysis and report preparation began during the summer of 1981 and continued through 1982, when drafts and partial drafts were submitted to the Corps. Completion of analysis and report preparation continued through most of 1984.

Project Reports and Their Contents

As noted, this report is one of several documenting results of the 1981-1984 survey and testing project. The first was entitled "The 1981 Archaeological Survey of the Libby Reservoir, Northwestern Montana: Annual Report" (Schalk 1981b). A plan-of-action for the 1982 field season and subsequent analysis entitled "Libby Dam-Lake Koocanusa Cultural Resources Survey: 1982" (Schalk and Thoms 1982) was submitted to the Corps and Forest Service prior to the second season of fieldwork. As part of the 1982 field season a draft statement--"A Field Manual/Guidebook for the Washington State University Libby Archaeological Project" (Schalk et al. 1982)--was prepared to serve as a guide to field methods and techniques and it also contained preliminary statements of the research design, regional geology, and culture history. Much of the information presented in the present report was summarized in the "Cultural Resources Protection Plan for the Libby Reservoir, Northwest Montana" (Thoms et al. 1984). The Protection Plan was finalized in early 1984 prior to completing the present report. Because all of the analyses had not been completed as of February 1984, some of the statistics in this report concerning the number and kinds of sites and their artifact content differ from those in the Protection Plan. The statistics in this report should be viewed as the final ones.

A popular summary for public distribution also was prepared as part of the project. It is in the form of a fold-out brochure concerning the history, prehistory, and geology of the project area.

The study of Kutenai Indian ethnography and ethnohistory was originally intended to be included in this report. Although not a complete ethnography (i.e., it does not address certain aspects of Kutenai culture--lifecycles, kinship, and linguistics--in great detail), the magnitude of that study required a separate volume. The resulting

promising sites for testing (selections mutually agreed upon by CNA and Corps archaeologists) to determine the limits of cultural deposits, their temporal and functional character, and significance; (4) analyze data to establish a chronology, artifact distributions, and assign function using the Montana State University, Libby Additional Units and Reregulating Dam (LAURD) systems, insofar as they are applicable to the purpose of this survey; and (5) present the results of the work in several reports including: (a) a final, technical report (this document); (b) a Plan-of-Action; (c) an annual summary report; (d) a popular summary; and (e) a draft management or cultural resources protection plan. It was estimated that fieldwork would include: (1) inventorying 205 sites; (2) recovering "grab samples" from 50 sites; (3) conducting grid collections at 15 sites; (4) conducting shovel and auger tests at 30 sites; (5) excavating 1 x 1 m test pits at 10 sites; and (6) mapping three historic sites (US Government 1981a:1-8, 11). In response to the Corps' Statement of Work, CNA archaeologists prepared proposals for fieldwork during the 1981 and 1982 seasons. These proposals (Schalk 1981; 1982) included a research design that directed the research effort and stated the methods and techniques to be used in response to the Corps' Statement of Work. Evaluation of cultural resources requires assessing their potential to yield information of scientific value. Toward this end, a number of questions or problems have been identified and they serve as the framework within which resources can be evaluated for significance as well as the basis for future management decisions. Some of these questions are mentioned here as an introduction to the research goals of the project. More detailed discussions are presented in subsequent chapters.

One such question concerns the variability in content and structure among sites situated on different landforms. Previous archaeological investigations suggest that sites adjacent to the Kootenai River are dominantly late Middle and Late Prehistoric in age (i.e., less than 3,000 years old). While those on terraces well above the Kootenai River tend to be early Middle Prehistoric sites (more than 3,000 years old or even earlier in age). This patterning of sites of different ages on different landforms may represent a shift in aboriginal land use practices. Alternative explanations for such a shift include climatically induced changes in subsistence and land use, or home range constriction associated with intensified land use practices. It is also possible that changes in site location are more directly related to changes in the river's elevation than to modifications of the settlement and/or subsistence system.

A second question concerns site or assemblage variability along the precipitation/vegetation gradient following the length of the reservoir. There is a reduction in mean annual precipitation of more than ten inches from south to north. This difference correlates with differences in vegetation and possibly the availability of game resources. Such environmental variability within the project area may be reflected in archaeological site content due to differences in season of occupation or site function, or both. Expected functional differences should be measurable in terms of differences in fire-cracked rock, animal bone, flaked stone tools, and debitage.

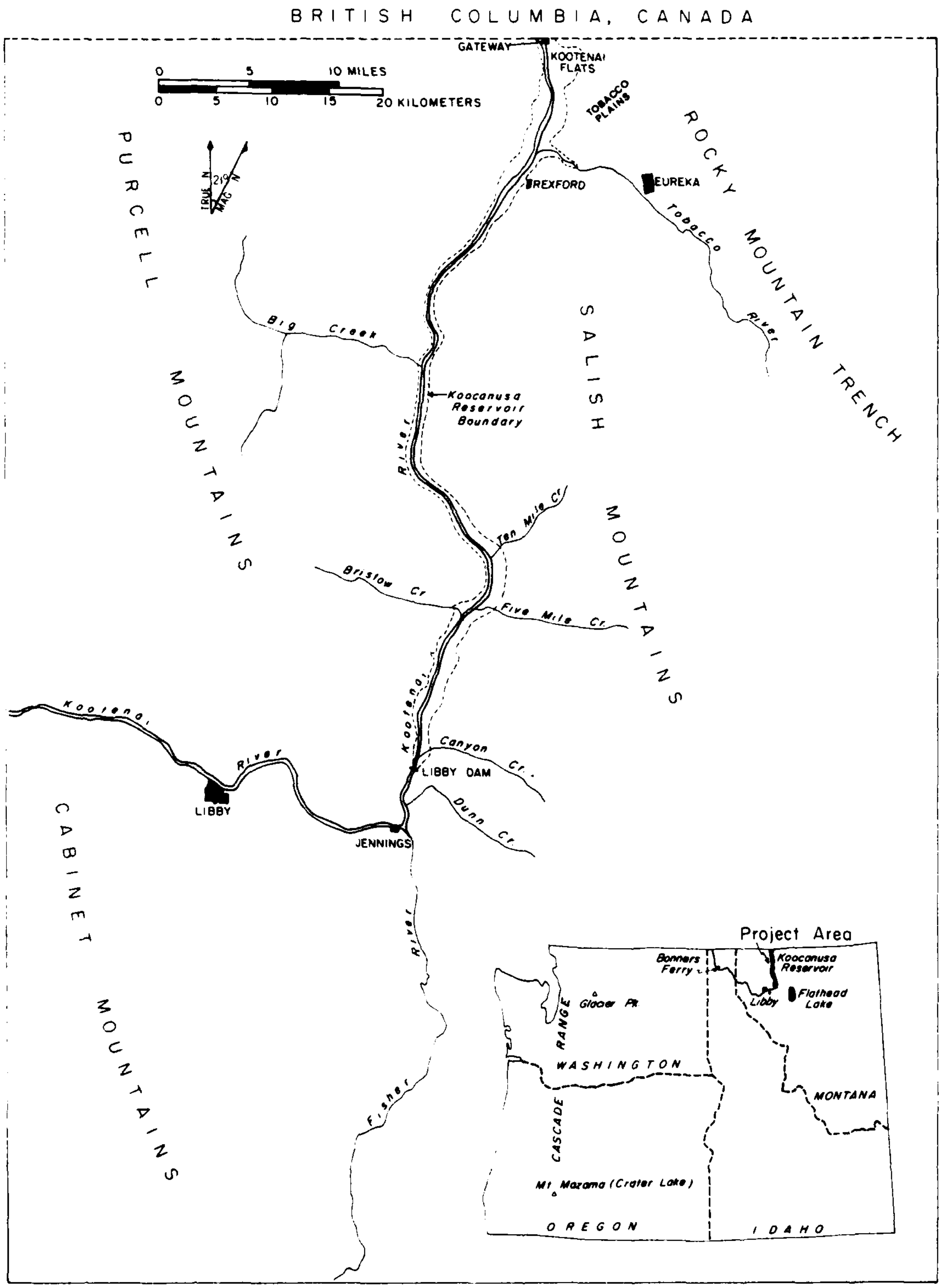

Figure 1-1. Map of the project area.

CHAPTER 1

AN INTRODUCTION TO THE 1981-1984 SURVEY AND TESTING PROJECT

by
Alston V. Thoms

This report documents the results of cultural resources survey and testing conducted in northwestern Montana by the Center for Northwest Anthropology (CNA), formerly the Laboratory of Archaeology and History, at Washington State University, Pullman, Washington. The study area--the project area and vicinity--lies within rugged montane forest country of the northern Rocky Mountains. Specifically, the project area is encompassed by Libby Reservoir and a 30 m wide border around the reservoir. Libby Dam impounds approximately 90 miles of the Kootenai River from the dam near Jennings, Montana to the vicinity of Jaffray, British Columbia. Libby Reservoir, also known as Lake Koocanusa (an acronym derived from Kootenai, Canada, and United States of America), is managed jointly by the Kootenai National Forest, Forest Service, US Department of Agriculture, the Corps of Engineers, and the British Columbia Department of Lands, Forests, and Water Resources. This report is concerned primarily with the 50 mile long section of the reservoir between Libby Dam and the international boundary (Figure 1-1).

Investigations reported here and in companion volumes were funded by the Seattle District Corps of Engineers, the builders and operators of Libby Dam. This report was prepared by CNA archaeologists and staff in partial fulfillment of contract numbers DACW67-81-C-0100 (Libby Dam-Lake Koocanusa Cultural Resources Survey) and DACW67-83-M-0522 (Libby Dam-Lake Koocanusa Cultural Resources Survey Reporting).

Project Goals

The project goals, specified in the contract Statement of Work (US Government 1981a) were as follows: (1) inventory the cultural resources on project lands for planning purposes; (2) record all exposed prehistoric and historic cultural resources in project impact areas; (3) evaluate significance of cultural resources to determine National Register eligibility; and (4) identify needs for additional cultural resources work and develop a management plan for project cultural resources. In order to assess cultural resources, the following tasks were required: (1) conduct a systematic pedestrian inspection (i.e., survey) of the ground surface in the project area (drawdown zone) to locate cultural resources; (2) at appropriate sites, conduct systematic surface collection to aid in evaluating site significance and project effects; (3) evaluate resources in terms of their research potential, heritage value, and immediacy of destruction or loss and select the most

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CHAPTER 2

HISTORY AND SUMMARY CULTURAL RESOURCES INVESTIGATIONS IN THE LIBBY RESERVOIR AREA

by
Alston V. Thoms

This chapter summarizes previous cultural resources investigations in the project area and vicinity. The first section focuses on descriptive results of projects carried out within the confines of Libby Reservoir. In the second section, more substantive results of investigations within and adjacent to the project area are summarized with emphasis on culture history and to a lesser degree on land use patterns. The chapter concludes with an evaluation of previous investigations in the project area. Information presented here largely concerns archaeological investigations, with previous ethnohistorical and ethnographic investigations being discussed in Volume II (Smith 1984). Important aspects of regional history are discussed in the study entitled "The Kootenay Fur Trade and Its Establishments 1795-1871" (Chance 1981). Choquette and Holstine (1980) provide a detailed discussion of cultural resources investigations prior to 1980 and culture histories that have been proposed for the northwestern Montana and northern Idaho and southeastern British Columbia regions.

A Brief History of Previous Cultural Resources Investigations in the Libby Reservoir Project Area

The earliest investigations in the Libby Reservoir or Lake Koocanusa area were ethnographic studies based primarily on interviews with Kutenai Indians and examination of early historical records. Although Schaeffer (1940) and Turney-High (1941) compiled detailed accounts of Kutenai lifeways, their investigations did not include detailed on-the-ground survey work designed to verify or discover the locations of historic Kutenai campsites mentioned in the literature or oral histories.

Archaeological field studies began in 1950 with the Smithsonian Institution's River Basin Survey, which was designed to discover archaeological sites that would be affected by the construction of Libby Dam. Shiner (1950) reported that half of the pool area was surveyed on foot and that remaining parts were so heavily timbered or steeply sloping as to preclude aboriginal habitation. Of the 11 sites recorded in the area only six--24LN5, 24LN7, 24LN8, 24LN9, 24LN11, and 24LN12--were in the area that would be inundated and only five of those are discussed in the report (Shiner 1950:6-8). All 11 sites were located very near the banks of the Kootenai River. Based partially on those results and partially on the few stone tools found or in local

collections, Shiner (1950:6) concluded that the reservoir area was characterized by a paucity of archaeological sites.

Plans for Libby Dam were finalized in the late 1960s and another cultural resources project was funded, this time by the National Park Service. In 1966, Dee Taylor (1973) and other University of Montana archaeologists implemented the survey and testing project. One historic site--24LN521--and 23 prehistoric or aboriginal sites--24LN501 through 24LN510, 24LN512 through 24LN518, 24LN520 through 24LN525, and 24LN530--were recorded. Test excavations were conducted at 11 of these. Once again, the majority of sites were located on lower terraces, very near the Kootenai River. Taylor's efforts to discover archaeological sites also were hampered by dense vegetation, but unlike Shiner, Taylor suspected the presence of sites on the higher terraces distant from the Kootenai River. He noted that "while surveying one had the uncomfortable feeling that he might be walking over dozens of aboriginal sites and never know it" (Taylor 1973:11). In fact, that is exactly what happened. Evidence for the occurrence of many sites would come only after reservoir clearing and post-impoundment erosion.

During a regularly scheduled drawdown in spring of 1975, David Munsell, a Corps of Engineers staff archaeologist, conducted a reconnaissance level survey in the Kootenai Flats and Bristow Creek areas of Libby Reservoir (Figure 1-1). He was the first archaeologist to examine the area after all of the living vegetation and most of the organic matter had been removed by the actions of reservoir water. At that time it became apparent that the area indeed contained many archaeological sites. Munsell recorded more than 20 readily visible sites (i.e., some of those in the 24LN1000 series) within small portions of the these two areas. Significantly, these sites had not been recorded previously (Jermann and Aaberg 1976:22).

In an attempt to estimate the number of undiscovered sites in the reservoir, the Corps of Engineers contracted with Montana State University for a six percent survey. The systematic sample survey was carried out during the spring drawdown of 1976 and 34 new sites (i.e., the remaining sites in the 24LN1000 series) were recorded (Jermann and Aaberg 1976). Nine of the sites were the remains of historic, Euroamerican structures; the others were aboriginal campsites. Results of this survey indicated that as many as 400 sites might still be present in the reservoir, but that most of them would "soon lose their potential scientific value either from erosion or deposition" caused by the operation of the reservoir (Jermann and Aaberg 1976:2).

Following the recommendations of Jermann and Aaberg (1976:79-89) the Corps of Engineers developed plans to fund a systematic and intensive survey of the entire reservoir to determine the nature and distribution of additional, but unrecorded, cultural resources. The intensive survey and testing project was eventually carried out by Washington State University and is the subject of this report.

Two other small surveys were carried out prior to the present survey. The first, conducted in March of 1978 by a Corps of Engineers

staff archaeologist, was designed to inspect the proposed locations of boat ramps for the presence of cultural resources. During that inspection three previously known and five unrecorded sites were documented (Salo 1978). The second small survey project was carried out by Montana State University archaeologists in 1979 (Roll and Bailey 1979). The purpose of this project was to intensively survey six small areas that would be affected by development of recreation factilities along the margins of Lake Koocanusa. Within these areas several known sites and five previously unrecorded sites--24LN188-24LN191 and 24LN193--were documented. Detailed surface observations and limited subsurface testing indicated that some of the sites had little depth (e.g., 24LN188, 24LN189, and 24LN191) and appeared to be severely disturbed by reservoir erosion. Others such as 24LN190 and 24LN1073 contained undisturbed cultural deposits and had the potential to yield significant information (Roll and Bailey 1979:12-26).

In the context of this review of previous work, it should be noted also that Forest Service archaeologists recorded one site in 1976 and another one in 1980. Both sites were located along the margin of Lake Koocanusa. The prehistoric site, 24LN72, was eventually incorporated into site 24LN388 and the historic cabins site (24LN47) near Cripple Horse Creek was removed during construction of the Lake Koocanusa Resort.

Cultural resources investigations also have been conducted in the Canadian portion of Libby Reservoir (Borden 1956; Choquette 1973a, 1973b). The kinds of sites reported are like those on the lower terraces in the United States portion of the reservoir. In addition, a number of investigations have been carried out in the area immediately below Libby Dam (Rice 1979; Munsell and Salo 1979; Roll 1976; Roll 1982). Most of these latter investigations were conducted in conjunction with the Libby Additional Units and Reregulating Dam (LAURD) project and entailed considerable excavation which revealed sites similar to those tested by Taylor (1973) on the lowest terraces of the Kootenai River, within the confines of what is now Lake Koocanusa.

Prior to implementation of the present investigation, approximately 90 sites had been recorded within the project area. Although several of these had been tested extensively, the resulting data were judged to be an incomplete basis for formulating sound management plans. A systematic survey was needed to determine the main types of cultural resources in the reservoir area, their relative frequencies, and their spatial distribution with respect to one another and to patterns of environmental variation. The survey and testing project reported here was designed to provide this information.

A Summary of Previously Proposed Culture Histories and Related Ideas

A review of the literature illustrates the tendency of investigators to compare prehistoric cultural materials from the project

area as well as, ethnohistoric, and ethnographic information with the "better known" archaeological and culture areas of the Plains and Plateau. During the first half of the twentieth century and somewhat earlier, ethnographers recognized the Kutenai Indians as linguistically distinct from surrounding groups, in terms of material culture; however, they resemble both Plains and Plateau groups (Chamberlain 1892; Boas 1918). The Northern or Upper Kutenai were said to have relied more on hunting, particularly bison, and thus resembled Plains groups as compared with the Southern or Lower Kutenai, who depended more on fishing, and were considered similar to Plateau groups (Ray 1939; Schaeffer 1940; Turney-High 1941).

Shiner (1950) accepted the implied cultural relationships between the Kutenai on the one hand and various Plains and Plateau groups on the other. Apparently, he considered the abundant game animals of the region to have been of more importance in aboriginal times than fish or vegetal resources. However, he argued that aboriginal habitation of the area was limited because of other environmental factors, particularly rugged terrain and an "extremely dense" forest. The grooved maul, an artifact traditionally associated with woodworking or plant or meat processing, was considered to be the most characteristic tool found in the area (Shiner 1950:6). Although Shiner (1950) did not propose a culture history, he apparently did not envision any substantial time depth for human occupation of the area.

Malouf (1956a) also recognized that cultural materials found in the project area and the region resembled artifacts from the Plains and Plateau areas, but he argued that the region--western Montana, northern Idaho, and southeastern British Columbia--had been occupied at least 6,000 years and that it was sufficiently distinctive to be designated a separate archaeological territory. Mountainous topography, high valleys with parkland vegetation, intermountain lakes, profuse vegetation, and a greater variety of plant foods and game animals made the "Montana Western Region" distinctive. A "Forager" period characterized by large, convex based projectile points with deep, corner to side-notches, and stemmed, indented base points, as well as knives, and unretouched flake scrapers, lasted until about 3,000 years ago and was succeeded by the "Late Hunter" period, characterized by an increase in bison hunting, a predominance of stemmed and corner-notched projectile points, and the presence of conical pestles and plano-convex scrapers (Malouf 1956b as cited in Choquette and Holstine 1980:36-37). Choquette and Holstine (1980) and Roll (1982) have followed Malouf's lead in viewing the region's subsistence resources and prehistoric lifeways as sufficiently distinctive to be recognized as such in the archaeological record.

As Roll and Bailey (1979:4-5) point out, most archaeologists working in the region have relied on the Early, Middle, and Late tripartite periodization developed by Mulloy (1958) for the northwestern Plains and modified by Reeves (1970). Most of the earlier culture histories were based on morphological similarities with projectile points from dated sites in the northwest Plains and to a lesser degree from the Plateau area.

In one of the earlier cultural historical reconstructions, Choquette (1971, 1973a, 1973b, and 1974) used climatic (e.g., Altithermal and post-Altithermal) and cultural period (e.g., Middle Prehistoric and Late Prehistoric) terminology for the Canadian portion of Libby Reservoir, but he largely followed Reeves' (1970) system. Lanceolate projectile points (e.g., Plainview-like) indicative of the Early period were not common, but were recovered along with a "grinding slab" from one site and considered to be suggestive of Altithermal and pre-Altithermal "temporal contexts" (Choquette 1974:5, 14). Presumably, the occasional "eared" projectile points (Oxbow-like) and indented base points (McKean-like) were considered characteristic of the early Middle period or the post-Altithermal context, about 5,000-4,000 B.P. (Choquette 1974:15). The "upper Middle" prehistoric and "lower Late" Prehistoric periods (ca. 3,000-1,800 B.P.) as indicated by large, corner-notched projectile points (Pelican Lake) are better represented indicating the area was occupied intensely by about 3,000 B.P. (Choquette 1971:8, 1974:15). Small, corner-notched and side-notched projectile points are quite common in the Canadian Libby Reservoir and are considered to represent the later part of the Late Prehistoric Period from about 1,800 to 200 B.P. (Choquette 1974:8).

Taylor (1973), in discussing sites located in the United States portion of Libby Reservoir, drew from the culture history developed by Reeves (1970) as modified by Choquette (1971). Because Taylor's (1973:110-126) culture history was the first explicit chronology used in the project area, it is summarized here. The Early Prehistoric Period (ca. 12,000-7,000 years B.P.) is essentially the Paleo-Indian big game hunting tradition of the western United States and is characterized by lanceolate projectile points like the Scottsbluff-Eden variety. Neither artifacts nor sites considered to be representative of this period were recorded by Taylor (1973) during his Libby Reservoir investigations.

Large, corner-notched projectile points (Pelican Lake and Besant) points are indicative of the Middle Prehistoric Period (ca. 5,000-1,450 B.P.). Only four of 26 sites were assigned to the Middle Prehistoric Period. Taylor (1973:115) suggested that the Libby Reservoir area was occupied during the latter part of the period by hunting and fishing peoples, who, may have traveled to the Plains to participate in large, communal bison kills and returned with meats as well as nonlocal lithic raw materials (e.g., blue-grey chert, chalcedony and red jasper). Interestingly, the 2,000 year gap (i.e., 7,000-5,000 B.P.) between Taylor's Early and Middle Prehistoric periods is what others (e.g., Reeves 1978 and Choquette and Holstine 1980) term the early Middle Prehistoric Period, characterized by the presence of large, side-notched points (e.g., Oxbow or Bitterroot side-notched). Apparently, Taylor did not feel this time period was represented in his sample.

Taylor's Late Prehistoric Period began about 1,450 years ago (ca. A.D. 500) and ended a little less than 200 years ago (ca. A.D. 1800). Corner-notched arrow points and later, side-notched arrow points are diagnostic. Other commonly associated tools include scrapers, knives, net sinkers, pestles, and mauls. Features characteristic of the time period include prepared hearths, roasting pits, and tipi rings. Deer

and elk hunting were important activities but so too was fishing and presumably gathering plant resources. Most sites were temporary camps of small groups, but some (e.g., 24LN10 and 24LN517) seem to have been occupied by several groups simultaneously (Taylor 1973:115-211). Nine of the 26 sites were considered to have been occupied during the Late Prehistoric Period and an additional eight were classified as Late Prehistoric and/or Protohistoric (Taylor 1973:111-112).

Diagnostic artifacts of the short-lived Protohistoric Period (A.D. 1800 to ca. 1880) differ little from those of the Late Prehistoric, except for the presence of trade beads and certain copper artifacts. Five of the 26 sites, including 24LN10 (located near the mouth of the Fisher River below Libby Dam) were assigned to the Protohistoric Period Kutenai Indians (Taylor 1973:112). Most recovered tools were indicative of hunting and butchering activities, and interestingly, Taylor (1973:123) found little evidence of fishing; despite the fact that ethnographic records indicate that fishing was important. Of course, gathering wild plant foods also was an important activity during the Protohistoric Period.

There are other culture histories for the region but they tend to include the basic patterns outlined above. The scheme outlined by Choquette (Choquette and Holstine 1980) is the most detailed, but it has been criticized (Roll 1982:54-55) for its lack of rigor. Choquette's scheme considers a great many factors--lithic technology, raw materials, diagnostic artifacts, settlement and subsistence patterns and paleoenvironmental conditions--but it is not well supported by the extant data base, although future work may demonstrate that the scheme was essentially correct. Roll's (1982) local cultural sequence is based on data derived from sites located adjacent to the Kootenai River and immediately below Libby Dam (i.e., the LAURD mitigation project) and it draws from Choquette's scheme to some degree. Roll's (1982) cultural sequence is primarily a projectile point typology; it is discussed in more detail in Chapter 7 of this report, as is Choquette's scheme.

Survey and testing carried out in conjunction with the LAURD project (Rice 1979; Munsell and Salo 1979) yielded results similar to Taylor's (1973). About 12 sites in the LAURD area were radiocarbon dated with a total of 24 dates. An additional six dates were obtained from buried soils at the sites (Rice 1979; Munsell and Salo 1979). These dates along with diagnostic artifacts and lithic raw material types were used to classify approximately 40 sites and their components (totaling about 83) according to broad time periods. The time periods were as follows: (1) Early Period (ca. 12,000-7,500 B.P.); (2) Middle Period (ca. 7,500-1,750 B.P.) which was divided into the early Middle (ca. 7,500-4,500 B.P.) and the late Middle (ca. 4,500-1,750 B.P. or A.D. 200); (3) Late Period (ca. 1,750-1,950 B.P. or A.D. 200-1755); and (4) Protohistoric Period, A.D. 1755-1800. Of the 30 dates, two were older than 4,500 B.P. and both of those were on buried soils (Munsell and Salo 1979:3-7). Rice (1979) concluded that almost all of the occupation of the area (i.e., the lower terraces immediately below Libby Dam) occurred between 3,000 to 500 B.P.. However, one of the sites (24LN1046) had a component with a small assemblage of non-diagnostic artifacts from below

Mazama ash (ca. 6,700 years old) and above the 8,170±100 (TX-3,220) year old,radiocarbon dated soil (Rice 1979:29-33). Thus, like Taylor (1973) concluded for the area immediately upstream and like Choquette (1974) concluded for the sites in the Canadian portion of Libby Reservoir, Rice concluded that most occupation of the lower terraces was during the late Middle, Late, and Protohistoric/Historic periods. There were, however, good indications of a more limited occupation during the early Middle, if not the Early periods.

The excavation results at six sites in the LAURD area (Roll 1982) were also similar to those of the LAURD survey and testing project (Munsell and Salo 1979; Rice 1979) with regard to the age distribution of archaeological deposits. There were few cultural materials assignable to the Early Period and earliest part of the Middle Period. Although projectile points representative of the Bristow Phase (considered to date ca. 5,500-4,500 B.P., during the early Middle period) were recovered from four of the six sites, they represented less than 5 percent of the projectile point assemblage at each site. Furthermore, at only one site (24LN1125) was the frequency of projectile points representive of the Calx Phase (ca. 4,400-3,300 B.P.) more than 10 percent. The Kavalla Phase, considered to be part of the late Middle Period (ca. 2,000-1,750 B.P. or A.D. 200), was well represented at most sites, as were phases of the Late Prehistoric and Protohistoric periods (Roll 1982). The investigators concluded that the paucity of cultural materials older than 3,500 years indicated that it was only after that date that comparatively intensive, probably intermittent occupation began (Roll and Singleton 1982:6.3-6.4).

Most investigators suggest that the middle Kootenai River region was occupied in prehistoric times by small bands of mobile hunters and gatherers who rarely formed villages or long term habitations prior to the Historic Period (Choquette 1971; 1972; 1974; 1978; Taylor 1973; Roll 1976). Food quest strategies are not considered to have remained static, although there is little discussion of the mechanisms and nature of changes. As a rule, changes are inferred from differences in projectile point forms, presence or absence of other tools (e.g., grinding and pounding tools and fishing related items), lithic raw materials, and rarely, faunal assemblages. For example, previous research in the Canadian portion of Lake Koocanusa indicate there was a change in subsistence patterns through time with deer being focused upon in the late Middle Period and bison being important in later times (Choquette 1972:19-20). Taylor, on the other hand, argues on the basis of lithic raw material and tool similarities with Plains groups that bison hunting may have begun during the Middle Period in the Kootenai region (Taylor 1973). Choquette's recent overview (Choquette and Holstine 1980:39-46) presents a general culture history and emphasizes settlement and subsistence changes as being closely tied to environmental change. He sees the area as being occupied by people during the immediate postglacial. During subsequent warmer and drier periods (8,000-5,000 B.P., 2,000-500 B.P.) people are considered to have occupied the higher terraces of the Kootenai in order to exploit upland resources where there was an increase in grasslands suitable for ungulate habitats. During cooler and moister periods (e.g., 5,000-2,000

B.P.), valley bottoms were utilized. Deer hunting, plant gathering, fishing, and perhaps fowling are believed to have characterized that subsistence pattern.

Evaluation of Previous Work in the Project Area

This section discusses the factors that controlled previous research and thus structured the current level of understanding about the nature and distribution of cultural resources in the project area. Elsewhere in this report, attention is focused on approaches others have taken to understand human behavior and culture history in the project area and the region in general.

The fact that previous work in the project area had revealed an incomplete picture of the nature and distribution of cultural resources can be attributed to several factors. These include: (1) the necessary incompleteness of coverage by small survey projects, (2) difficulties in locating sites obscured by heavy vegetation cover or the operation of geologic processes, and (3) changes in the state-of-the-art of archaeological research emphases and methods, including the defintion of a site or other analytical units.

Cultural resources investigations conducted prior to the 1970s focused principally on lower terrace sites. Sites subjected to intensive subsurface testing tended to be larger ones with more abundant cultural material; they also tended to be relatively young. As a result, little is known about the smaller and older sites located on, or in the lower terraces. These are the sites that may be most similar to most sites found on the middle and higher terraces.

Shiner's and Taylor's 1950s and 1960s work was state-of-the-art, but the methods and techniques, as well as the problem orientations employed by archaeologists working in the 1980s are quite different. Previous investigations often were concerned with developing regional culture histories. These efforts were hampered either by a lack of organic materials for radiocarbon dating or by a lack of funds to date organic remains found at some of the lower terrace sites. However, the work conducted in conjunction with the LAURD project (Munsell and Salo 1979; Rice 1979; Roll 1982) has and should continue to yield important chronological information due to the abundance of datable remains recovered. Most of the dates fall within the latter part of the Middle Period and the Late Prehistoric Period. Thus, the first several thousand years of probable human occupation are indicated not by radiocarbon dated sites, but by "diagnostic" projectile points.

Most investigators have assumed that the Kootenai River area was part Plains and part Plateau in its cultural affiliations, even though it has been argued that the area is environmentally and culturally distinctive enough to be considered separately. An alternative approach is to compare the cultural materials from Libby Dam-Lake Koocanusa with those from the area that is most similar to it environmentally, namely,

the montane boreal forests located north of the project area. This approach would also focus on how groups of people lived in and used the Kootenai environment, as opposed to developing a culture history that relies on comparison with materials found in quite different ecological settings.

Studies of land use patterns in the reservoir area also have been hampered by several kinds of problems. First, the cultural materials at most sites have low survey visibility and are thus difficult to find. As noted, vegetation and ground cover was dense prior to inundation and the only bare ground was often that around rodent burrows, tree tip-ups, and game trails. Because many sites in the reservoir are characterized by relatively abundant fire-cracked rock but relatively few pieces of chipped stone and animal bones (especially in comparison with many areas in the Plains and Plateau regions), the likelihood that sites will be discovered at all is low. In the second place, once found there is a strong probability that the few pieces of fire-cracked rock and the occasional chipped stone artifact visible in the small, natural exposures will be dismissed as relatively inconsequential. In fact, such sites may contain thousands of pieces of chipped stone buried just beneath the surface. Even if there are only a few artifacts at the sites, they may be representative of readily intelligible land use systems. Unfortunately, once a site has been judged insignificant, the chances are slight that it will be subjected to subsurface testing although it may be revisited and surficially examined.

Even prior to reservoir inundation the lowest terrace and banks of the Kootenai River were naturally active landforms subject to erosion and deposition during seasonal flooding. Taylor (1973) tried to relocate all sites recorded during the Smithsonian Institution's survey (Shiner 1950), but was unsuccessful in four cases, presumably because either flooding had removed or buried the sites, or because some type of construction or agricultural practices had destroyed them or obscured their presence. Jermann and Aaberg (1976) point out that within the denuded, rapidly eroding drawdown zone, sites are being exposed and buried continuously. The result is that cultural materials exposed at any particular site during one day may be buried the next day (or week, or year) and an entirely different set of artifacts and features exposed. In some instances the site cannot even be relocated. Such occurrences hamper thorough site evaluations based on surface examinations alone because the same site is necessarily described differently at different points in time.

To summarize, cultural resources investigations in the project area began more than 30 years ago. During the intervening time period, evaluations of the potential archaeological significance of the reservoir area have changed considerably. Initially considered to be an area having only a few unimportant sites, it now can be characterized quite differently. Through the years of continuing investigations, it has become increasingly apparent that the cultural resources in and adjacent to the reservoir are likely to yield information useful for understanding general past human lifeways and specifically lifeways in a mountainous environment.

CHAPTER 3

THE MONTANE CONIFEROUS FOREST ECOSYSTEM OF NORTHWEST MONTANA AND VICINITY

by

Randall F. Schalk and Robert R. Mierendorf

This brief review of the past and present regional environment is intended to provide a background for subsequent and more detailed discussions of the geology of the project area and the research design which structured the retrieval and analysis of data from the project area. The chapter begins with a summary of paleoenvironmental conditions. Emphasis is on the geological processes that conditioned and shaped the Kootenai River valley prior to and during the initial occupation of the region by human groups. Such processes were partially controlled by climatic changes, which also influenced the distribution of plant and animal resources exploited by human populations. Furthermore, knowledge of past environmental conditions is crucial to explaining the locations and contents of archaeological sites. The second section focuses on the modern ecosystem and provides information about the kinds and structures of food resources available to human groups living in the area. It is considerably more detailed than the section on paleoenvironmental conditions because the research design is related more closely to the nature of the historic montane coniferous forest ecosystem than it is to any specific paleoecosystem. More detailed information about the past environment in the project area is presented in Chapter 7 which deals with late Quaternary and Holocene landforms and stratigraphy, and their relationship to archaeological deposits

Paleoenvironmental Conditions in Northwestern Montana

For clarity of presentation, the following discussion proceeds according to four broad time periods labeled the late-glacial, the periglacial, and the interglacial. These informal terms are used to convey both the dominant geologic processes accompanying exposure of a "new" landscape following glacial retreat, and the transitional nature of these processes over the long time span between full-glacial and interglacial conditions (Wright 1983). The time boundaries between periods are approximate and are not presumed to have utility outside the project area.

The Full-Glacial (23,000-14,000 years ago)

Between 22,000 and 18,000 years ago, during the last full-glacial period, over 4,000 feet of glacial ice covered the rivers and mountains

(Alden 1953; Waitt and Thorson 1983) in the Libby and Eureka areas (Figure 1-1). This massive sheet of ice was formed by the coalescence of numerous smaller mountain glaciers in British Columbia and northern Idaho and Montana. The build-up of this ice sheet in the project area after 23,000 years ago is inferred from the age of a radiocarbon dated sample of plant remains found under glacial deposits at the mouth of Big Creek (see Appendix H).

Movement of this ice mass left distinctive evidence of its ability to sculpt the landscape. Parallel grooves and striations cut into bedrock by rock debris encased in the glacial ice (Johns 1970) and the prominent drumlin field in the Eureka vicinity (Alden 1953; Clague 1975a) indicate that the ice moved in a southerly direction, down the Kootenai River valley and along the Rocky Mountain Trench toward Flathead Lake. This portion of the Cordilleran ice sheet (referred to as the East Kootenai lobe, following Alden 1953 and Waitt and Thorson 1983) advanced south of present day Libby, Montana, up the Fisher River drainage, and possibly into the Thompson River drainage (Alden 1948). The ice sheet overrode all but the highest peaks in the Purcell and Salish Mountains. This resulted in the rounded appearance and subdued relief of these ranges as compared with the rugged Cabinet Mountains south of Libby, Montana, which were not overridden. Evidence is lacking for human occupation of northwestern Montana during this period of maximum ice advance.

<u>The Late-Glacial</u> (14,000-11,500 years ago)

The retreat of the East Kootenai lobe from northwestern Montana is not well dated, but was probably synchronous with worldwide physical and biotic changes in the environment between 14,000 and 11,000 years ago (cf. Porter 1983). The pattern of deglaciation in the project area was broadly similar to one proposed by Fulton who suggested that "on a regional scale, ice receded from the mountainous areas and hilly uplands while stagnant, climatically dead ice remained in the major valleys and topographic basins" (1971:16). During the final stages of glacier melting in the project area, deposits of rock debris and entrapped ice were left where the glacier once stood. As ice chunks melted, surrounding sediments collapsed, leaving mounds of rock debris pitted with depressions that today are visible as the numerous lakes and rolling hills in portions of the Eureka and Tobacco Plains areas. Meltwater from the shrinking ice masses flowed into temporary lakes and streams. Two such lakes have been recognized in the project area. The earlier one is represented by buff colored clay deposits exposed along the northern reservoir margin in the Tobacco Plains zone (see Modern Physiographic section this chapter). This lake probably resulted from temporary blockage of Kootenai Valley meltwater channels by the freshly deposited rock and ice debris. A later lake stand, called Glacial Lake Kootenai by Alden (1953), deposited a thick sequence of silts and clays in the central and southern parts of the reservoir, herein termed the Upper and Lower Canyon zones, respectively. This lake was probably created by a temporary ice or moraine dam somewhere west (downstream) of the project area (Alden 1953; Boettcher and Wilke 1978).

The earlier of these lakes existed before 12,200 years ago based on radiocarbon dated plant remains from deposits along Elk River just north of the project area in British Columbia (Harrison 1976). By that time the ice mass had retreated into Canada, leaving portions of the Kootenai Valley ice-free and available for establishment of pioneer vegetation.

Glacial Lake Kootenai existed prior to about 11,500 years ago based upon the identification of two distinctive volcanic ash layers dating to this approximate time period and stratigraphically overlying the lake deposits. This was a time of rapid adjustments to the newly deglaciated landscape as the freshly exposed and unstable glacial deposits moved down steep mountain slopes and tributaries, adding a large influx of sediments to the Kootenai River valley.

Environmental conditions in the project area during the period of ice melting and glacial retreat were not conducive to intensive human occupation of the area primarily due to the dynamic nature of the landscape. Climatic conditions were severe by modern standards and plant and animal resources were seasonally and geographically restricted. A recent review of vegetation history indicates that newly deglaciated terraine in the Northwest was generally colonized by tundra with subsequent replacement by subalpine-like forests (Heusser 1983). As the climate continued to warm, plant and animal resources became increasingly abundant, but archaeological studies do not demonstrate that people utilized resources from the area during this period, although it is possible that as yet undiscovered sites exist. In the unglaciated Snake River drainage south of the study area, such as central and southern Idaho, there is evidence of human occupation between 15,000 and 11,000 years ago (Butler 1978; Ames et al. 1981).

<u>The Periglacial</u> (11,500-8,500 years ago).

About 11,500 years ago the Kootenai River began to downcut through the thick glacial deposits that filled the Kootenai Valley to an elevation of about 2,500 feet. Based on a radiocarbon date from the vicinity of Dunn Creek, just below Libby Dam, it is known that by 8,200 years ago the river had completed this downcutting process and flowed at about its present level (Rice 1979; Munsell and Salo 1979).

Although the overall warming trend that triggered the retreat of the glaciers continued, there were still periods of cold, subarctic-like conditions. Prominent frost features observed on early Kootenai River alluvial terraces dating between approximately 11,000 and 9,000 years ago suggest a wet and cold environment. The summer months must have been a time when streams were swollen with meltwater from local mountain glaciers and snowfields and from the continued melting of the Cordilleran ice sheet in Canada. During these seasons of high discharge the Kootenai River flowed through a maze of major and minor channels that intersected one another and occasionally blocked one another as they deposited channel bar complexes. These sand bars became exposed to the wind during low river levels, and provided the sediment source for the dunes in the Kootenai Flats area and the thin sheet sands capping each abandoned river terrace preserved along the valley walls.

In the early part of this climatic period, the timberline may have been lower than it is today (Baker 1983). Based upon fossil pollen recovered from nearby lakes, vegetation in the project area consisted of somewhat open forests of pine and fir with sagebrush and grass in open areas; such associations are characteristic of subalpine settings today (Mack et al. 1983:188). Toward the end of the period, more mesic forests became widespread and climatic warming resulted in a decline in the frequency of spruce and fir. Accompanying this warming trend was an overall upward shift in the elevational zonation of plant and animal communities. This climatic trend corresponds with the formation of a soil, radiocarbon dated to 8,800 years ago, under the dunes in Kootenai Flats (Appendix H). The earliest evidence for human occupation of the area, although sparse, is found in sediments dating near the end of this period; however, evidence is absent for human occupation of the stable land surfaces on which this soil formed. Instead, the earliest demonstrable evidence for human use of this landscape occurs within the thin deposits of aeolian sands capping the early Kootenai River terraces (Mierendorf 1984).

The Interglacial Period (8,500 years ago to the present)

By the beginning of this period, the Kootenai River had cut its channel to about the level it flows at today. Heavy snow accumulation in most alpine areas ceased, and vegetation reflecting a drier and warmer climate expanded. The eruption of Mt. Mazama about 6,700 years ago deposited volcanic ash which is preserved as a discrete layer in areas of relatively rapid deposition, such as the dunes in the Kootenai Flats area and in the active Kootenai River floodplain. Beginning around 4,000 years ago, the climate became cooler and wetter, and mountain glaciers among widespread western ranges made a brief but recognizable readvance (see Burke and Birkeland 1983). Seasonal runoff from such increased snow accumulation may have resulted in numerous changes in landforms immediately adjacent to the active Kootenai River channel, and in the formation of new channel bar complexes in the Kootenai Flats area which again made sediment available for another phase of dune building. For the most part, however, most landforms within the Kootenai Valley had stabilized and the overall configuration of the valleys and mountains remained unchanged over the last 8,000 or so years. Pollen records indicate that such trees as spruce and fir became more common at this time. Except for some comparatively minor changes in distribution of forests and grasslands or in the type of dominant plants, the overall climate and appearance of the Kootenai area has been similar to today's for about the last 2,000 or 3,000 years. Based on the presence of diagnostic artifact styles, there is abundant evidence for human occupation and utilization of the area for the last 5,000 years.

Modern Physiographic and Climatic Controls

From its source near the headwaters of the Columbia River in southeastern British Columbia, the modern Kootenai River flows south along the western flanks of the Rocky Mountains through the Rocky Mountain Trench and into the United States. At the international boundary the Kootenai River enters the project area and a geographic feature known as the Tobacco Plains (Figure 1-1) a broad, open parkland with numerous glacial features such as drumlins, eskers, and kettle lakes scattered across the wide valley (Alden 1953:58-59). Where the Kootenai leaves the Rocky Mountain Trench near Rexford, Montana, it receives the Tobacco River, the largest tributary in the project area. A few miles downstream from this confluence, the Kootenai enters a rugged, forested canyon through which it flows until it departs the project area at Libby Dam. Below the dam, the Kootenai bends sharply to the west at Jennings, Montana and flows along that general course towards Idaho, whereupon the river takes a northerly course to its junction with the Columbia River in south-central British Columbia.

Elevations within the project area and vicinity range from about 2,000 feet (610 m) above mean sea level (amsl) in the valley bottoms to near 7,000 feet (2,134 m) amsl for the higher peaks in these portions of the Purcell and Salish mountains adjacent to the Kootenai River. Numerous creeks with narrow valleys drain these two ranges and enter the Kootenai River at regular intervals. The prereservoir floodplain of the Kootenai was less than a mile in width throughout the canyon sector and the sides of the canyon rise with slopes of 50 percent or more.

Because of the north-south axis of the mountain ranges in this region and prevailing winds from the west, precipitation belts run roughly north-south as well. Mean annual precipitation varies directly with elevation but also is affected by complex, localized rain shadow effects. The Tobacco Plains vicinity, for example, receives only 15 inches of precipitation a year, an amount insufficient to support continuous forest vegetation. Downriver, mean annual precipitation increases to 25 inches or more at the same or lower elevations. Much higher levels of precipitation are received upslope.

According to Blair (1955), snow accumulations on the valley floor in project area typically range from 6 inches to 2 feet. However, storm tracks move through the mountains in patterns that result in localized "wet spots" along the river valley.

Libby, Montana has a growing season of only 80 days (Pacific Northwest River Basins Commission 1970:127). While temperature data were not availale in the sources examined for this study, observations during field seasons of 1981 and 1982 indicated that the growing season would even be shorter at Eureka. Light snowfalls in March and April obscured the ground and made survey prohibitive for periods of several days in the Tobacco Plains area yet the same snowfalls melted by mid-morning at the southern end of the reservoir and were minimally disruptive to survey activity there. This temperature gradient appears

Table 3-2. Spawning Characteristics for Resident Fish

Species	Spawning habitat	Spawning sea n
Rainbow trout (Salmo gairdneri)	Small tributaries to rivers or inlet/ outlet streams of lakes	Mid-April to late June
Westslope cutthroat trout (Salmo clarki lewisi)	Small, gravelly streams	February-May
Longnose sucker (Catostomus catostomus)	Streams; sometimes shallow areas of lakes	Mid-April to mid-May
Largescale sucker (Castomus macrocheilus)	Deeper, sandy areas of streams but occasionally gravelly or sandy shoals in lakes	Mid-May to late June
Burbot or ling (Lota lota)	Shallow water under ice in lakes; sometimes post-spawning movement into tributary streams	January-March
Dolly Varden (Salvelinus malma)	Tributaries to lakes or rivers	October
Mountain whitefish (Prosopium williamsoni)	Tributary streams	October-early November
Northern squawfish (Ptychocheilus oregonensis)	Gravelly shallows along lake shores; sometimes lower portions of tributaries	May-June
Redside shiner (Richardsonius bolteatus)	Shallow riffles in streams; sometimes lakes	May-late June
Longnose dace (Rhinichthys catarache)	Swiftly flowing streams; lakes	May-July
Peamouth chub (Mylocheilus caurinus)	Shallow, shore waters of lakes	May-June

NOTE: Information presented in this table was extracted from Scott and Crossman (]973).

the lichens and mosses that are critical to its winter diet. In view of recent evidence which suggests deliberate forest burning by Native American people in this region extending back at least six centuries (Barrett 1981), it may be surmised that the initiation of that practice would have benefited other game species at the expense of caribou.

Riparian Resources

The inaccessibility of all of the Kootenai River above Kootenay Lake for anadromous fish has a profound effect upon the potential productivity of an aboriginal fishery. It is because of the lack of anadromous fish in this portion of the Columbia River drainage that it has been termed the Barrier Falls subarea of the Columbia-Fraser Plateau culture area (Roll and Singleton 1982). The Kootenai drainage is inhabited exclusively by freshwater resident species whose productivity is limited. Freshwater fish production tends to vary with the level of primary production and plankton provide the first step of the food chain. Photosynthesis is severely limited each year by cold temperatures and by surface layers of ice that do not permit penetration of sunlight into the water of lakes and streams. The low levels of primary production in cold water environments like those of the study area mean that a significant proportion of the energy entering the aquatic food-chain is in the form of organic detritus from surrounding land areas (Odum 1971:317). Without unearned productivity available in the form of anadromous fish that have benefited from the greater productivity of marine environments, highly seasonal freshwater environments have relatively low standing crops of secondary biomass and relatively low turnover rates.

In light of these arguments regarding low levels of fish production in this environment, it is apparent that exploitation of individual fish species by humans would be focused upon seasons during which fish are most concentrated--i.e., the spawning season. It is unlikely that native freshwater fish would have served important roles in aboriginal subsistence except when they were exceptionally aggregated. Having presented reasons for focusing upon spawning habits of the freshwater fish, it is appropriate to examine the seasons during which the various species spawn. Spawning habitat and season data for native species of potential subsistence value in the project area are shown in Table 3-2. Although these data are generalized for the entire geographic range of the various species and therefore not necessarily precise for the project area, several facts stand out. It is apparent that there are, in descending order of importance, three periods during which all these species spawn: spring/early summer, fall, and mid-winter. Of the 11 species considered, 8 can be considered spring/early summer spawners, 2 can be considered fall spawners, and 1 a mid-winter spawner.

In examining the habitat preferences shown in Table 3-2, it is also evident that small creeks and tributaries to rivers and lakes constitute the preferred settings for the majority of species. While several species may spawn in lakes even though these are not preferred habitat,

Because of the patchy nature of their habitat and their reported tendency to abandon areas where they are subjected to hunting (Geist 1971), it is unlikely that sheep would be exploited at the same locations on any regular or yearly basis. Because sheep do not rapidly expand their ranges, overhunting can result in long term range abandonment and population reduction. It may be that use of sheep as a buffering resource during infrequent intervals of failure of other resources as reported among the Nunamiut (Binford 1978), was a typical pattern of exploiting sheep. Due to the predictability of their spatial occurrence and their lack of resilience to hunting pressure, it is expected that sheep would not be exploited in the same areas annually but rather on an irregular basis.

Between Jennings and the international boundary along the Kootenai Valley, mountain sheep range is presently confined to the east valley wall between Cripple Horse Creek on the south and Stonehill (near McGuire Creek) on the north (Blair 1955:Figure 37). Some sheep are also reported to be on Sheep Mountain which is several miles up Five-Mile Creek Valley (Charlie Husec, personal communication). Summer range is represented by Blair as extending to the tops of the mountains; lower elevations paralleling the Kootenai River and fingering up the north sides of tributary valleys are represented as winter ranges (Blair 1955).

Caribou (Rangifer tarandus)

Although caribou are unlisted in the fauna of the project area today, they occur in limited numbers in the Selkirk Mountains of Idaho's panhandle. It is believed that caribou were pushed north in the recent past from a range that extended as far south as Idaho's Salmon River (Larrison and Johnson 1981). Northwestern Montana lies close enough to this southerly limit that it is probable that this species was never very numerous under past climatic conditions like today's.

The distinction between forest and tundra forms is apparently significant insofar as there are major morphological and behavioral differences between them (Burch 1972:342). All woodland caribou make extensive use of lichens and tree mosses in their winter diet and all are migratory and their movements typically take place between higher alpine environments in the summer to lower elevation, mature forests in the winter. It is likely that any caribou present in the middle Kootenai region during most of the Holocene would have been of this forest type. When periglacial conditions prevailed here, however, the tundra adapted form may have been present.

Forest caribou, besides moving less than the tundra caribou during their yearly cycle, also tend to live in smaller herds (Burch 1972). The caribou is supposed to be an easy animal to hunt and, if present in any quantity, would almost certainly have been utilized by humans. This species is of particular interest in that it alone among the ungulates native to this ecosystem is adversely affected by forest fire. This is the result of the caribou's need for old growth forests as a source of

(Smith 1984). Hunting practices, game protective measures, forest fire suppression, and a variety of impacts during the past hundred years are important but as yet inadequately controlled variables. By extrapolation from modern data to the past, however, elk populations are not expected to be as numerous as those of either white-tailed or mule deer.

Mountain Sheep (*Ovis canadensis*)

Unlike other large mammal species discussed above, mountain sheep are relatively patchy (i.e., not spread uniformally over the general landscape) in their distribution in this environment. Being grazers, they rely on patches of grassland that occur where conditions of slope, aspect, and precipitation combine to produce sufficient dryness that grass is dominant in the plant community. Habitat requirements for sheep are further restricted to places where nearby cliffs and rugged slopes offer protection from predators. Although sheep utilize grasslands maintained by burning, these are considered secondary habitat. In this last respect, sheep contrast with deer, elk, and moose which benefit from early seral stages of vegetation maintained by burning. Mountain sheep prefer climax plant communities with grass as a dominant. Vegetation communities dominated by grasses have a patchy and restricted distribution in the mountainous Kootenai environment.

Sheep move between two and seven seasonal ranges during a particular year and the ranges may be separated by distances of up to 20 miles or more. Movement between these seasonal ranges is apparently quite predictable if the sheep are not hunted by humans.

These home ranges are inherited and there is a strong attachment to the same ranges from generation to generation. Though sheep are considered to be a pioneering species that invade new deglaciated areas, they do not readily extend their ranges unless appropriate habitat becomes rather continuously distributed as it must have during early post-glacial times and again during much warmer time periods (Geist 1971).

Periods of migration between seasonal ranges occur at least five times during the year resulting in a complex annual pattern of movement (Geist 1971). These migrations include movement to winter areas (late September to early October), movement by rams to rutting areas (late October to early November), movement of rams from their rutting areas (late December to early January), movement by rams and ewes to late winter/spring ranges (late March), movement of females to lambing areas and males to salt licks (late May), and finally the movement by all but ewes and lambs to summer ranges (late June to early July).

Though sheep may remain at high elevations during the winter, by late winter they are increasingly confined to south-facing cliffs where snow accumulations tend to be reduced. Dispersion from this late winter range begins in about mid-March to south-facing slopes where the first green sprouts emerge.

of cold weather in late fall, elk descend as far and as fast as they are pushed by the accumulating snow.

Field studies show that elk spend most of the winter on slopes with good solar exposures--south, west, and southwest facing slopes--and that the majority (75% or more) of these slopes are greater than 40 percent (Judd 1971:12). Here again, solar exposure and angle of solar incidence enhance accessibility and abundance of forage in these winter settings.

Winter diet consists predominantly of browse, especially the tender terminal portions of shrubs and conifers (Hash 1973). Some preferred browse species in this region include serviceberry, chokecherry, snowbrush, kinnikinnick, redstem ceanothus, ninebark, and cottonwood. Many of these are found in greatest abundance where the forest canopy is most open or as components of early forest successional stages following forest fires or other disturbances. As with nearly all ungulates in this environment, elk show a strong preference for areas that have been burned.

From the above, it is clear that elk and deer have considerable overlap in the browse species they utilize. Although deer are strong competitors with elk where their winter ranges coincide, there are important distributional differences and elk tend to occupy slightly higher elevations than deer during the winter. Their larger size permits greater mobility in deep snow as well as access to browse that is beyond the reach of deer.

Elk migrations range from 5 miles to more than 35 airline miles (Judd 1971) and are frequently larger in scale than those of deer. The distribution of elk is more patchy than that of deer. Within the Jennings-Gateway Management Unit, elk herds were concentrated in the early 1950s in four tributary valleys: Alexander, Dunn, Canyon, and Cripple Horse creeks (Blair 1955). Although their migration patterns here have not been carefully investigated, it is believed that elk wintering on the west side of the Kootenai River occupy summer ranges to the northwest and those wintering on the east side of the Kootenai occupy summer ranges to the north of the Wolf Creek-Kootenai divide (Blair 1955) which lies southeast of the project area in the Salish Mountains. Movements between the seasonal ranges for elk seem to be significantly greater than for the other large herbivores in this environment. These migrations frequently involve the funneling of animals through river crossings such as at Jennings, where they would have been vulnerable to intercept hunting.

The distribution and abundance of elk in the Northern Rockies has been subject to large changes in the past century. Between 1919 and 1926, for example, it was estimated that all of Lincoln County had no more than 30 elk (Blair 1955:Table 2). During this same interval, deer population estimates for the county never dropped below 10,000. While elk herds had increased substantially by 1954, there was still a ratio of nearly 23 deer for every elk. The past abundance of elk relative to other ungulates in this area is difficult to estimate. However, similar trends have been noted in the historical and ethnohistorical records

and the end of May, 462 were mule deer and 60 were white-tailed and the remaining 68 deer were not identified to species. Because these observations were made along the two reservoir-marginal roads which traverse winter ranges of both species, the pattern does not appear to result from biases in the locations sampled.

(2) Mule deer typically occur in larger groups during this season of the year. The average group size of mule deer was 5.2 whereas the average for white-tailed deer was 2.2 individuals. Variation in group sizes is considerably greater for mule deer than for white-tailed. The minimum group size for both species was one, whereas the l_rgest group of white-tailed deer included five individuals and the largest number of mule deer in a group was 23.

(3) There was a decrease in the average group size for both mule and white-tailed deer over the observation period. Average number of mule deer per sighting decreased from 5.5 during the month of April to 3.8 in May. Average number of white-tailed deer per sighting in April was 2.2 as compared to 1.6 in May. These figures seem to reflect a general dispersion into smaller social units.

(4) The total numbers of both species dropped markedly between April and May. In April, there were 291 recorded mule deer and 38 recorded white-tailed deer. The same counts for May were 46 and 13 respectively. Though samples are small, this trend corresponds with the beginning of the warm season dispersion to higher elevation.

In summary, data collected on a casual basis during fieldwork along Libby Reservoir indicates that the ratio of mule deer to white-tailed deer has increased since the data reported by Blair (1955) was collected in the late 1940s. Whether this apparent change is the result of impoundment impacts, natural oscillations in relative abundance of game populations, or inadequacies in the procedure for data collection, or other factors is difficult to say. It does, in any case, appear that spring triggers changes in the distribution, abundance, and group size of the two deer species. This evidence suggests that the interval between April and May marks the season during which mule and white-tailed deer begin to disperse into smaller groups as they follow the receding snow upslope and expand onto their summer range.

Elk (*Cervus canadensis*)

Like deer, elk are migratory throughout the Rocky Mountains and patterns of their range use are also similar to deer. In general, they are dispersed widely and at much higher elevations during the summer. Blair's (1955) data indicate that elk winter range in the Jennings-Gateway Management Unit amounts to only 4.2 percent of the summer range. In other coniferous montane settings such as along the Lochsa River of Idaho, elk winter along the river at elevations between 3,000 and 3,300 feet (Judd 1971). Elk follow the snowline upslope and by late summer, they have moved up to 5,800 feet elevation (Judd 1971). With the onset

Table 3-1. Summer Range Deer Densities in Various Environments.

Density (deer/km^2)	Environment	Source
0.8-2.3	"Primary deer range" North Dakota	Wallmo 1981:7
<0.8	"Secondary deer range" North Dakota	Wallmo 1981:7
1.9 white-tail	Pine-oak-hickory forest Lee County, Alabama	Sweeney et al. 1971
15.4 white-tail	Pine-scrub oak Walton County, Florida Dry upland	Sweeney et al. 1971
4.6-6.2 white-tail	Dry upland; 15 year old pine plantations, few abandoned fields Plant, Aiken, South Carolina	Sweeney et al. 1971
11.6-13.5	Bottomland and river swamp with mixed hardwoods and cypress	Sweeney et al. 1971
41-65 black-tail	Productive coastal ranges of California	Wallmo 1981:212
10-15 mule	Foothills of Montana	Wallmo 1981:212
3.5-11 mule	Badlands of Montana	Wallmo 1981:212
1-5 mule	Open prairies of Montana	Wallmo 1981:212
4-5 mule	Arizona chaparral	Wallmo 1981:369
45.4 mule	Burned California chaparral	Wallmo 1981:373
16.9 mule	Unburned California chaparral	Wallmo 1981:373
19-23 black-tail	Tillamook Burn, Oregon (1964)	Wallmo 1981:432

higher. Using Blair's figures of winter range area for white-tailed deer (122 km^2) and for mule deer (150 km^2), it is apparent that winter ranges for these two species represent only 6 percent and 7.4 percent of the summer range, respectively. For the winter of 1947-1948, white-tailed winter population density was 10.35 deer/km^2, mule deer winter population density was 13.4/km^2, and the combined density for the two species was 15.9/km^2. This compares favorably with another archaeological study which sought to estimate game animal populations and concluded that deer and other species were abundant in the project area (Roll and Henry 1982).

These figures can be placed into a broader context through comparison with density estimates for other areas of North America. Table 3-1 lists a number of deer density estimates from a wide variety of environmental settings. The overall densities of deer (represented by summer range density) in the study area compare poorly with many settings of North America. North Dakota and eastern Montana prairies, for example, approximate most closely the summer density estimates for the Libby area. Winter range densities, while they are more comparable, still do not approximate the very high figures for areas of California's coastal range and burned chapparal. Recalling that winter range area is compressed with the amount of snow accumulation, it is probable that winter range densities in the montane forests of northwest Montana would rise considerably higher for at least brief intervals. For example, Schmautz and Zajanc (cited in Roll n.d.) report white-tailed densities of up to 53 deer/km^2 in the Fisher River-Wolf Creek Unit. Similarly, during the excessive snow accumulation of 1954 in this same area, Blair (1955:59) reports white-tailed deer being restricted to the extent that there was 0.99 acres per deer for a period of nearly a month. This would amount to a winter range density of approximately 250 deer/km^2. Obviously, this is an extreme case and there is evidence for overpopulation and overbrowsing of the range; however, this example illustrates the great variability in game population densities.

The points to be emphasized are that deer densities can be quite high on a seasonal basis, exceptionally high in years of extreme weather conditions, and that the latter situation is capable of producing a major regional population die-off through starvation. Also, it must be emphasized that <u>seasonal</u> densities should not be confused with year-round or overall densities. Overall densities for deer in the Kootenai Valley are by no means exceptional compared to other environments in North America.

During the 1982 field season, records of game sightings were kept by project field crews. Notebooks were kept in each vehicle for entries of the species and number of individuals observed, time, date, and location of observation. Though there is little doubt that lack of a systematic sampling procedure places limitations on generalizations from these data, certain broad patterns can be identified with reasonable confidence:

(1) <u>Mule deer outnumber white-tailed deer by a ratio as high as 5.8:1.</u> Out of a total of 610 deer observed and recorded between mid-March

is postulated that pregnant female deer rely upon the first green succulent plant growth occurring on these sites to meet energy demands for fetal growth during the last one-third of gestation and lactation in June (Sneegas and Bumstead 1977).

Protein is critical in the spring months due to the lack of it in the maintenance diet of forage during the winter season. New growth tends to have very high protein content so that the distribution of areas with good solar exposure is of great importance to deer and other large herbivores.

White-tailed deer prefer brushy river bottoms and lower, less rugged terrain than do mule deer. In this regard, Blair (1955) suggests that the unusually rugged terrain of the Jennings-Gateway Management Unit may account for the nearly 2:1 ratio of mule deer to white-tailed deer. This characteristic distinguishes the study area from the Fisher River Valley and areas further downstream near Libby, Montana (Blair 1955). Blair also provides figures for the degree of overlap in winter ranges for various big game species. Mule and white-tailed deer have considerable (21.4%) overlap in their winter ranges in the Jennings-Gateway Management Unit. Both species were observed routinely along the reservoir during archaeological field investigations in the spring of 1981 and 1982. Given considerable overlap in the food habits of the two species it is possible that competition may be occurring as a result of various, recent environmental changes (Anthony and Smith 1977).

Throughout the Rockies, summer range is believed to provide sufficient forage for deer (Wallmo 1981:123). In the Jennings-Gateway Management Unit there is an "overabundance of excellent summer range" (Blair 1955:68). It is obvious that the amount and quality of winter range serves as a strong limiting factor on deer populations as well as on other indigenous ungulates (Stelfox and Taber 1969).

It follows from this discussion of seasonal ranges and deer migration that densities of deer vary markedly through an annual cycle. In general, distribution varies from highly dispersed in the summer to highly concentrated in the winter. To give some idea of how this variation could affect abundance from the viewpoint of human utilization, some actual population estimates from the project area can be examined.

Blair (1955:Table 2) provides estimates of deer (both white-tailed and mule deer) populations for Lincoln County, Montana for the interval 1919-1954. Unfortunately, yearly population estimates over this interval for the project area are not available. There are however, estimates for the study area for the winter 1947-1948 and trends evidenced in Blair's data suggest that this was an above average year for deer populations. He estimated that there were 1,260 white-tailed and 2,010 mule deer in the Jennings-Gateway Unit in 1947-1948. Using the total land area of the unit (2,024 km^2) as a measure of the summer range, white-tailed deer density was 0.62/km^2 and mule deer density was 0.99/km^2. Density for both species of deer over the summer range would then be about 1.6/km^2. Winter densities, however, are substantially

is little doubt that game populations are responsive to them. The notion of game "carrying capacity" in this sort of environment can only be applied in very dynamic terms.

The Deer Resource (*Odocoileus* sp.)

Two species of deer--white-tailed (*Odocoileus virginianus*) and mule deer (*O. hemionus*) are today the most abundant and ubiquitous ungulates of the Northern Rockies. Fortunately, there is reasonably good published data on the general ecology of deer in the montane forest environment (cf. Wallmo 1981) as well as prereservoir management information on game resources for the project area (Blair 1955). Blair's study defines a "Jennings-Gateway Management Unit" which extends from near the present site of Libby Dam to the Canadian border. This management unit includes the Kootenai Valley and its tributary along this reach. Beyond serving as a convenient unit for the purposes of this project, the Jennings-Gateway Management Unit is also distinguishable in biological terms from surrounding regions by "natural and distinct segregation of wintering herds" (Blair 1955:34). According to Blair, most deer migration occurs within watersheds so that management units based upon drainage divides correspond well with annual game movement.

As mentioned previously, topography and climate together require a migratory response for deer and other ungulates in this region. Summer range for deer includes virtually this entire area and extends from the valley floor (about 2,000 feet elevation) to the mountain crests bordering the Kootenai Valley (up to 7,000 feet). Deer begin to disperse over this entire range in late March or early April as the snowline rises. With the onset of winter snowfall, deer are concentrated at successively lower elevations. Such "yarding" typically begins in late October in this region (Blair 1955:68) with the extent of range contraction in some areas of the Rockies being measured by summer, early winter, and late winter deer range ratios of 125:25:1 respectively (Wallmo 1981:392). Degree of range contraction also varies with annual variations in winter severity so that milder winters find deer at higher elevations and vice versa (Wallmo 1981:387; Blair 1955:68).

Besides elevational differences between winter and summer ranges, there are also differences in aspect. Steep south-facing slopes are preferred winter foraging areas for deer because they have less snow accumulation, have more forage low to the ground, and provide the first new growth in the early spring. During the summer on the other hand, greater use is made of densely timbered north and east facing slopes (Blair 1955:50). Late winter and early spring find deer in places where the first forbs begin to turn green (Sneegas and Bumstead 1977); ungulates tend to spend a large percentage of their time on such south-facing slopes at this season of the year:

> Solar energy studies in Montana reveal that the maximum intensity of radiation during April and May is received on south-facing slopes with an angle of 30-40 percent slope. It

The distribution of snowfall, and especially variations in the amount of snow cover at different elevations, are responsible for major yearly shifts in the availability of animal forage. In many years, the snow depth at higher elevations renders game forage or browse inaccessible. The response to such seasonal changes in the availability of forage is migration and all large game species in this environment tend to shift their seasonal range along an elevational gradient. Generally, winter ranges occur at lower elevations where depth of snow accumulation is reduced. Summer ranges are more elevationally dispersed. Animal movement between summer and winter ranges is, therefore, an important quality of game behavior in this environment even though some of these same species tend to occupy the same ranges (true territories) throughout the year in other regions of low relief. In the Kootenai Valley, winter ranges tend to be below 4,000 feet elevation; on south facing slopes winter forage may be available above this elevation and on more northerly aspects, well below it (Blair 1955). Game migration amounts to a progressive contraction beginning in the fall and early winter with the accumulation of greater amounts of snow at successively lower elevations.

This annual cycle of compression and expansion of game forage results in dramatic changes in game densities. In general, summer game are widely dispersed compared to a pattern of winter aggregation. Frequently, game densities may be an order of magnitude higher on winter as compared with summer ranges; depending upon the severity of winter climate, the winter range may be less than 10 percent of the area included in a summer range. Game animals, especially deer, tend to congregate at select lower elevations during the winter, a characteristic know as "yarding."

A third quality of ungulates in this environment is that nearly all seem to benefit from the increased quality and abundance of forage that accompanies early stages of forest succession. Although logging is the most important factor promoting early succession stages in recent decades, natural and/or human induced forest fires have been the major factors in prehistoric times.

A fourth and important characteristic of game in the mountain environment is that populations fluctuate dramatically over relatively short intervals of time. This population cycling seems to be more pronounced with increasing seasonality, and substantial game fluctuations are especially well known for subarctic and arctic regions. While the exact causes for population cycling may be complex and poorly understood, the effects of weather on game populations in the Northern Rockies are readily apparent. Winters with especially heavy snow accumulations can produce large-scale starvation. It is likely that the frequency of population crashes among ungulates in the Rocky Mountains increases towards the higher latitudes (Wallmo 1981:387). Several such crashes are documented in historic records for the area (Smith 1984). Climatic contols over forest fire frequencies are such that prolonged dry intervals may result in widespread areas of early succession that have profound consequences for the quantity of game forage in a region. Such changes occur at the scale of decades and even centuries and there

species such as mountain maple, nannyberry, serviceberry, snowberry, rose and kinnikinnick; (4) open grassy or brush hillsides interspersed with browse species such as mock orange, ninebark, serviceberry, snowbrush, redstem ceanothus and chokecherry.

The Tobacco Plains deviates from this general description. Here, rain shadow effects produce a grassland environment that resembles the "High Plains."

Aspect contributes in a major way to the vegetation mosaic. The drier south and west-facing slopes tend to support open ponderosa stands. North and east-facing exposures and higher elevations tend to be dominated by more mesic Douglas fir, lodgepole pine, Engelmann spruce, and western larch. The influence of aspect on vegetation is most dramatically expressed in the Lower Canyon Zone, where the east-west trending tributary valleys create strong north-south contrasts in aspect and vegetation types. These differences are further influenced by the asymmetric cross section of the valleys, with the north-facing slopes being steeper than south-facing ones; the former exhibit closed canopy forests while the latter support open forests (e.g., compare forested slopes on the left of Figure 3-2 with those on the right side).

Adding to the complexity of this vegetation patterning is the occurrence of lightning and human-caused forest fires which produce extensive patches of brushfield in the forest and all subsequent stages of forest succession. Even-aged stands resulting from fires within the past century can be distinguished at a distance as large patches with a color slightly at variance from that of the surrounding forest. During especially dry years and/or years with exceptional lightning frequencies, very large areas of forest are burned. The effects of the widespread 1910 burns are still evident in the Kootenai Valley today. Recent studies of burn scars on ponderosa pine indicate that human-induced fires must also be recognized as a factor contributing to vegetation patterns in the past (Barrett 1981), though it is not known how long aboriginal people may have utilized this practice. Lightning fires seem to occur with a greater frequency at higher elevations and the largest stand-replacing fires also occur at higher elevations. It was within the lower elevation forests, however, that Native Americans most often set fires and these are believed to have been smaller, more frequent fires that did not result in the replacement of stands.

General Characteristics of Ungulate Ecology in the Montane Forest

In response to broad environmental controls within the Kootenai Valley, (e.g., topography, climate, vegetation zonation), the major ungulate species share a number of characteristics in their ecological adaptations. Before reviewing the ecology of individual game species, consideration is given to some of these commonalities.

Figure 3-1. Typical view across the Tobacco Plains Zone, the Canadian Rockies in the distance.

Figure 3-2. Typical view along the narrow Upper Canyon Zone.

Figure 3-3. Typical view along the Lower Canyon Zone.

to be correlated with an elevational gradient. In any case, the growing season in Eureka, Montana is probably less than 80 days.

Topographically, the project area can be divided into three principal zones:

(1) Tobacco Plains. This zone extends northward from the mouth of Pinkham Creek to the northern limits of the project area at the International Boundary and beyond (Figure 3-1). It is distinguished physiographically from the other two zones of the project area by its generally broad, low-relief setting and the different vegetation it supports, namely an open pine forest interspersed with grasslands.

(2) Upper Canyon. This central zone is an exceptionally rugged and narrow canyon (Figure 3-2). With the exception of Big Creek, the tributary valleys entering along this reach are short and steep. Vegetation is the densest in this zone.

(3) Lower Canyon. This zone extends south from a point (the mouth of Volcour Gulch) between Five Mile and Ten Mile creeks to Libby Dam, at the southern limits of the project area and continues on downriver (Figure 3-3). It is characterized by a broader canyon with numerous large east-west running tributary valleys. South facing valley walls are characteristically covered with parkland-like vegetation, while those slopes with poor solar exposures often support a closed canopy coniferous forest.

These three zones were established as major environmental strata and were employed in the sampling design for selection of sites for testing. More is said about these principal environmental divisions of the project area in Chapter 5 of the report.

Regional Vegetation Patterns

Although the Kootenai Valley in the project area is a coniferous or boreal forest environment, the vegetation association consists of a mosaic of conifers, broadleaf trees, grassland, and brushfields. In general, vegetation communities correspond with the elevationally distributed climatic zones, but as already noted there are important differences along the north-south axis of the project area. Blair (1955:66) describes the prereservoir vegetation between Jennings and Gateway (see Figure 1-1) as follows:

> . . . (1) streambottom types consisting primarily of broadleaf species such as cottonwood, birch, alder, dogwood and willow; (2) open ponderosa pine types on the southern and western slope exposures with a ground cover of various browse species such as serviceberry, chokecherry, snowberry, Oregon grape, spirea, ninebark, nannyberry and snowbrush; (3) dense Douglas fir-western larch-lodgepole pine types on the northern and eastern slope exposures with a ground cover of various browse

only the burbot, squawfish, and chub appear to prefer lacustrine spawning habitats.

The fishery resources, then, would probably have been of greatest consequence in the spring with fall and mid-winter seasons of secondary importance. Also, the focus of these fisheries would have been on the tributaries that enter the Kootenai along its reach through the project area. The size of various runs up these small tributaries would be conditioned in part by stream size and accessible length. One would also expect that the Tobacco River as the largest tributary in the project area would support the largest runs and that creeks deriving from minor valleys and those with very steep gradients would be relatively inacessible to fish.

Still further insight into the subsistence potential of the fishery is gained from information on the size of runs of particular species into individual streams. According to Bruce May (personal communication 1982) of the Montana Department of Fish and Wildlife, prereservoir runs of rainbow trout and other species into tributaries such as Big, Barron, Bristow, Jackson, Canyon, Cripple, Horse, and Five Mile creeks would have numbered no more than a few hundred fish. In addition, these resident trout would have been considerably smaller (less than 8 inches) than many of those inhabiting lacustrine or reservoir environments. In short, a total annual run for one of these tributaries might amount to less meat than is available in one deer. It would diminish the importance of the aboriginal fishery even further to consider how long the stocks spawning in individual tributaries would take to recover from one season of intensive use by humans.

Plant Resources

Plant resources that are edible by humans also occur in considerable variety,though due to the short growing season, none seem to be especially productive or concentrated in their distribution. For this reason, plant resources probably did not contribute a major part of the diet and they do not seem to have occurred in sufficient quantity to be stored and used to support groups of people through the winter when vegetal resources were not available. Valley bottoms, open ponderosa forests, and recently burned areas tend to be the most favorable areas for production of edible plant foods. In such locations balsamroot, mule-ears, camas, bitterroot, buckwheat, yarrow, chokecherry, serviceberry, huckleberry, and many other roots, greens, and berries can be found in limited quantities. The inner bark of ponderosa pine, tree moss, and certain pine seeds also occur in the area and were used by Native American groups Smith (1984). Even so, the project area as a whole did not produce enough plant foods that they could be considered a staple food source (Roll and Henry 1982). However, utilization of even limited quantities of plant foods probably was of critical importance to maintaining adequate nutrition for aboriginal populations in the area (Speth and Spielmann 1983).

CHAPTER 4

PREHISTORIC LAND USE IN THE MONTANE CONIFEROUS FOREST

by

Randall F. Schalk

Research design provides a means for measuring the significance of individual cultural resources and is an essential component of any study that attempts to evaluate the scientific value of those resources. Besides providing the framework for assessing resources for eligibility for the National Register as a part of the inventory procedure, research design also gives direction to the process of data acquisition to assure that important kinds of information are recovered and appropriate observations are made. This chapter represents an effort to develop such a framework.

At the beginning of this study, three general and interrelated kinds of questions were posed (Schalk 1981a):

(1) What kinds of prehistoric land use systems were present during the Holocene within the Kootenai Valley?

(2) Does the archaeological sequence reflect a static record of aboriginal land use through the Holocene, or is there evidence for directional change such as subsistence intensification and the process of "settling in"?

(3) To what extent were land use systems of the historic Kutenai a continuation of earlier, prehorse and precontact systems?

These questions are of particular interest because the extant literature on the Kootenai Valley is most notable for the lack of attention to matters pertaining to aboriginal land use. In the face of this deficiency, it might seem as if the region was one of enormously stable adaptations or, more precisely, a region in which a single kind of cultural system persisted throughout the Holocene, with little more than minor changes in formal tool inventories.

Land use as it is referred to in this study includes both what people do for a living, and the spatial organization of how they do it. Subsistence and settlement systems are both components of a land use system. The interdependencies between settlement and subsistence make it impossible to develop predictive models of one without similar models of the other (Bettinger 1980:222). In the sense used here, land use is a holistic concept:

> Whereas settlement pattern generally refers to the distribution and patterning of specific sites or activity loci

> over a landscape, the concept of land use is somewhat broader and refers not only to settlement pattern in the strict sense, but to the cumulative impact of subsistence, technology, and settlement on the ecosystem as a whole. The perspective of land use is especially important in seeking to identify the direct or indirect impacts of a human group on its environment, thus initiating or intensifying environmental change or instability. The role of fire as an agent of ecological change in the humid tropics, deforestation of the temperate zone, and possible extinction of Pleistocene game animals are examples of human induced impacts on the environment with major implications for cultural adaptation (Kirch 1980;139).

It was anticipated in planning the first season of work in the Libby Reservoir that the primary archaeological date that would result from this project would be of three basic kinds: (1) site locational data, (2) assemblage content data, (3) and site structural data. In general, questions pertaining to aboriginal land use systems appeared to offer the most promising means for effective use of these data classes. A research design focusing upon land use also seemed to be the most appropriate context for evaluating the significance of the numerous cultural resources that were expected within the drawdown zone of the reservoir.

Four other factors also suggested that aboriginal land use ought to be given primary attention in the study. The large size of the project area and its riverine setting are characteristics which led to the expectation that a considerable variety of sites, both in the temporal and functional sense, would be encountered within the reservoir drawdown zone. The project area comprises two linear strips of land paralleling the reservoir for a distance of about 50 miles of the Kootenai Valley. Topographic variation from the steep canyon settings of the central reach of the reservoir to the broad, low-relief settings of the Tobacco Plains in the northern part of the project area also indicated the likelihood of encountering sites of different season/functional usage. It seemed likely that an area of this scale and diversity would allow investigation of more of the settlement variability potentially present in the entire region than had been possible in many previous studies.

The first factor conditioning the focus of this study was the nature of previous archaeological investigations in the area. The earlier research projects in the US portion of the reservoir (Taylor 1973), the Canadian section of the reservoir (Choquette 1971; 1972; 1973a; 1973b), and in areas adjacent to the reservoir (Roll 1982; Rice 1979) tended to deal primarily with cultural historical and chronological questions rather than with settlement systems. From the reconnaissance and small scale survey efforts in the reservoir during the years following impoundment (David Munsell, personal communication; Jermann and Aaberg 1976; Roll and Bailey 1979), it was suggested that many of the newly discovered sites were older than those which received the greatest attention during the prereservoir data recovery effort. In this context, the present survey offered the opportunity of achieving a perspective on prehistoric settlement of greater temporal depth.

A second factor was that the total absence of vegetation within the drawdown zone permits virtually 100 percent ground surface visibility. Heavy vegetation and low ground surface visibility are the typical conditions for archaeological survey in forested regions of the Northern Rockies and the degree of visibility present in an extensive reservoir drawdown zone appeared to be exceptionally high. This condition is apparently unique for northern Idaho and northwestern Montana and it was one which promised maximum potential for documentation of cultural resources within the project area.

A third consideration was that the ethnographic record of the aboriginal inhabitants of this region elicits some important questions regarding land use systems of the Historic Period and the degree to which these were representative of or similar to those of the earlier periods evidenced in the archaeological record. In particular, the Upper Kutenai are documented as equestrian peoples who made as many as three annual bison hunting expeditions east of the mountains (Turney-High 1941). They are also known to have travelled to the headwaters of the Columbia to fish for salmon in the fall of the year. Their settlement system seems to have been substantially dependent upon the use of horses (Malouf 1974), yet no previous archaeological research in the region had been aimed at the question of how prehorse settlement systems of earlier times would have differed from the Upper Kutenai as known from ethnography and ethnohistory. Thus, there was an interest in formulating an approach that was independent of the ethnographic record so that this record could be evaluated critically rather than assumed at the outset to be directly applicable to the prehistoric, prehorse occupants of the region.

A fourth consideration involved in the process of developing a research design was that attention had been directed toward understanding long term changes in settlement and subsistence in other cultural resource projects undertaken by Washington State University since 1978 in the Columbia Plateau (Schalk 1980, 1983a, 1983b; Mierendorf 1983; Thoms et al. 1983). Viewed in the context of the Columbia drainage as a whole, the most salient characteristics of the Kootenai Valley are that it lies above hydrological barriers for anadromous fish, is largely a forested region, and is situated in a rugged mountainous setting. Given the central explanatory role assigned to changes in the use of anadromous fish in most synthetic statements on the archaeology of the Plateau (Schalk 1984), the Kootenai Valley offered an unusual opportunity to investigate long-term land use changes in a portion of the Columbia River drainage basin that lacked salmon.

General Characteristics of Hunter-Gatherer Land Use in the Boreal Forest

Most anthropologists and archaeologists who have worked in this region have pictured the Kootenai Valley as a marginal area to the Plains and the Plateau. Within a cultural historical explanatory

framework in which contact with surrounding cultures and diffusion of traits from "climax areas" are viewed as the driving forces of culture change, the Northern Rockies emerge as a cultural backwater where all developments are seen as secondary to those occurring in more dynamic core areas elsewhere. While objections occasionally have been raised that this region deserves separate status as a culture area (cf., Malouf 1956a; Choquette and Holstein 1980), such objections miss the fundamental point. Viewing this region in terms of the culture area concept and the assumptions that approach makes about the causes of culture change has obscured the fact that environmentally the Northern Rockies area is more like the boreal forest than the Plains or the Plateau. In fact, it would probably be much more accurate to consider the forested regions of the Northern Rockies as a southerly peninsula of the boreal forest, a vast biotic zone that extends across the continent of North America. While there are clearly transitional qualities about the environment of this area, the ecological principles that most accurately describe the ecosystems of the Northern Rockies are much closer to those associated with boreal or temperate coniferous forest than with grassland or steppe settings.

Boreal forest settings are noted for having high primary biomass, low secondary (animal) biomass, fine-grained vegetational mosaics, dispersed game resources and a high degree of climatic and biotic variance from year to year as well as over longer intervals of time (Winterhalder 1981; Ives and Sinopoli 1982). The animal food resources that can be consumed by hunter-gatherers in an evergreen forest are relatively inaccessible. Primary production is largely confined to the forest canopy and is of minimal direct benefit to humans or to many of the herbivores of greatest importance to humans. Animal biomass production often tends to occur more in the form of small rodents than in ungulates, and here again accessibility presents a real problem for human exploitation (Kelley 1983).

The commonalities shared by most ethnographically documented hunter-gatherers of the boreal forest include exceptionally low population density, a high degree of residential mobility, minimal dependence upon food storage, large home ranges, small local groups, and primary dependence upon the hunting of mammals. The consequences of being largely at a carnivorous trophic level combined with the tendency for dramatic resource cycling, are that very large home ranges are required and mobility is very high. Fishing is typically of secondary importance to hunting and plant resources are always of minor importance.

Summer tends to be a season of scarcity because game resources are dispersed and are not inhibited in their movement by snow. Edible plant production during the growing season is quite limited and freshwater fish runs tend to occur either in the spring or the fall. The combined effect of these conditions is that human populations are highly dispersed during this season--often into single family groups that can forage while making frequent residential moves. Winter season groups tend to be small bands (15-30) that are large enough to provide the minimum cooperative labor requirements for effective hunting of large

game yet small enough that resources within the day-radius of a residential camp are not exhausted too rapidly (Rogers 1963). The largest yearly coresident groupings often occur for a brief period in the spring in association with fish spawning runs and these aggregates may include multiple winter season bands.

These generalized qualities of hunter-gatherer settlement and subsistence in boreal settings can be viewed as responses to the distribution of food resources in highly seasonal forest environments. While hunter-gatherers in the Northern Rockies can reasonably be expected to have shared most of these tendencies, a less normative approach requires that attention be directed at how the environmental characteristics of this region would constrain settlement systems.

Mobility Strategies in the Montane Coniferous Forest

Differences in mobility strategies are of fundamental importance in understanding settlement variability among hunter-gatherers and these strategies are strongly regulated by the distributional structure of food resources in the environment (Binford 1980; Kelly 1983; Schalk 1978:93). Virtually all other aspects of settlement and subsistence strategies are hierarchically integrated into the overall mobility strategy. Two basic patterns of movement may be distinguished (Binford 1980): (1) residential mobility which involves the movement of both producers and dependents, as in the case of reestablishing a base camp at a new location, and (2) logistic mobility which involves the movement of producers; during resource procurement activities they depart from and return to a central habitation site where dependents reside. These two types of movement are combined in varying proportions to produce the mobility strategy characteristic of particular adaptations.

Boreal forest hunters (e.g., Mistassini Cree) have been referred to as "serial specialists: they execute residential mobility so as to position the group with respect to particular food resources that are temporally phased in their availability through a seasonal cycle" (Binford 1980:17). With exception of those areas of the boreal forest where unearned aquatic resources (especially salmon) were available, resource distributions in this biome are such that a "collector" type of land use system is not a possibility. Highly abundant and localized resources suitable for storage are not available.

It is argued that the ecosystem of the project area would necessitate a settlement system that approximates the residentially mobile "forager" model. A question that arises at this juncture is what, if any, long-term changes might be expected in the archaeological record of this region? Can one expect the persistence of a relatively unchanging settlement and subsistence system throughout most of the Holocene, responding only in minor ways to environmental change? Or, on the other hand, might there be detectable changes in settlement in the direction of more intensive land use systems?

Subsistence Intensification in the Montane Coniferous Forest

The discussion to this point has presented a highly static picture of land use. It could be interpreted as making a case for the existence of a single, "relict" cultural system at all times in the prehistoric record of this region. It has been argued, for example, that logistically organized settlement systems and seasonal sedentism based upon food storage are not likely possibilities in this environment. Although evolutionary changes towards more intensive land use systems are reflected in the archaeological sequences of many, even most, regions of the world, no attention has been given to possible changes of this sort that might occur in this environment. While emphasizing similarities of this region to the boreal forest biome, some of the distinctive qualities of the Kootenai Valley have been neglected. These qualities are of interest in considering the potentials of this environment for intensification under conditions of increasing population.

Due to its southerly location within the boreal forest and the maritime effects of the Pacific Ocean on climate, the Kootenai Valley is probably a relatively productive setting for game compared to other areas of the boreal forest. It is clear too that the diversity of large game resources is quite unusual. Caribou and moose are the primary ungulates present over most areas of the boreal forest. This contrast suggests that natural population cycles might be less profound in their impact on human subsistence due to a wider variety of resource alternatives. Given higher levels of game productivity and diversity, one might expect that annual range sizes as well as mobility would be somewhat smaller than those usually associated with boreal hunters in areas of more severe winters and lower game resource diversity. It has been shown that home range sizes tended to increase across the boreal forest from west to east in Canada along a gradient of decreasing productivity (Hallowell 1949; Rogers 1969:45).

It is also likely that resource distributional structure would differ to a degree from that associated with many other boreal forest biomes. Due to elevationally regulated concentration of game in winter yarding areas, as well as to the presence of ungulate species such as deer, elk, and mountain sheep that occur in small to moderate-size herds, resource distributional structure is probably more patchy than most other areas of the boreal forest.

Also due to the milder climatic conditions characteristic of the Kootenai Valley, it is expected that plant resources would have at least slightly greater importance in aboriginal subsistence than in the more seasonal areas of the boreal forest. Viewed comparatively within the range of variablity in settlement systems of the boreal forest, then, hunter-gatherer settlement in the Kootenai Valley is expected to fall near one end of the spectrum. Home ranges should be relatively smaller, residential mobility somewhat lower, and human carrying capacity somewhat higher than most other areas of the boreal forest lacking anadromous fish.

The land use intensification model adopted here amounts to an explanatory framework for specifying the causes and nature of directional changes in settlement and subsistence systems. It is a basic premise of this model that an imbalance in the population-resource relationship is the main impetus to change in land use. Such an imbalance can be caused by population change and/or by environmental change which results in a change in resource productivity, predictability, or distributional structure. While either population increase or environmental deterioration operating independently would produce the same effect (i.e., stress), the two forces are expected to interact as ultimate and proximate causes in many instances. Climatic changes, according to this view, act as triggering mechanisms or catalysts to precipitate change that is driven by population increase.

The long range adaptive problem to be solved through selection for organizational changes in the settlement-subsistence is obvious: how to increase the productive capacity of a finite area of land. It is arguable that the evolutionary solution to this problem in certain areas of the world was plant domestication and agriculture, in other areas intensive harvesting and storage of wild plant foods (e.g., acorns in California), or in still others intensive fishing coupled with storage (e.g., the central Columbia Basin). But how would intensification proceed in an environment with the limitations that have been discussed for the Kootenai Valley? That is, where highly concentrated and seasonally abundant resources suited to bulk storage are unavailable or scarce, what alternatives are there for intensification of subsistence?

The model formulated for this study proposes that subsistence intensification in this environment would involve: (1) enhancement of resource productivity by maintenance of early stages of vegetation succession through deliberate use of burning; and (2) broadening of the resource mix to include resources that are more costly to exploit in terms of the currencies of optimal foraging: search, pursuit, and processing costs. Examples of such resources in this environment would be plants, aquatic resources, and smaller game species. Both responses are the expectable consequences of density-dependent selection favoring adaptations that require less space. Increasing dependence on fishing would be one example of how more costly or labor intensive food resources might be added to the diet and, globally speaking, systematic aquatic resource use is frequently a relatively late addition to subsistence in many archaeological sequences (Binford 1968; Osborn 1977; Cohen 1977). Plant resources, though argued to be of very limited potential at this latitude, would nonetheless offer another class of resources that could be expanded in a minor way at least. Human induced burning, especially in the lower elevation settings so important for winter forage of game in this region, undoubtedly would have beneficial effects on the productivity of a variety of plant resources though the principal purpose and effect would probably be to enhance large herbivore densities (especially deer and elk). Although substantial areas of the coniferous forest are burned as the result of lightning ignitions, deliberate burning would increase the amount of forest maintained in early seral stages and would increase the frequency with which certain locations would burn under completely "natural"

conditions. Besides augmenting forage for herbivores and humans alike, human ignited fires would be placed where they would have the most beneficial effects. In this region, these areas would be the valley bottoms and walls below about 4,000 feet in elevation where game winter ranges are concentrated. The burning of low elevation settings with good solar exposures would be consistent with the winter foraging preferences of large game discussed in the previous chapter.

Under conditions of increasing human population, there would be increasing pressure to develop subsistence strategies that support more people on a given area of land. The use of fire as a means for increasing productivity would seem to offer the greatest potential for intensification of subsistence in this environment. Evidence from historical records (Leiberg 1900), forestry research (Barrett 1981; Barrett and Arno 1982), and pollen studies (Mehringer et al., 1977) suggest that fire was a component of native subsistence patterns. The suggestion here is that the deliberate and controlled use of fire would have substantially augmented the benefits associated with naturally occurring fires. Controlled use of fire implies that the location and season of burning as well as the interval between burns at a given location could be regulated to maximally enhance productivity of important human food resources. It is argued, then, that compared to the spatial and temporal occurrence of naturally induced forest fires, human caused fires would have a far greater potential to increase the carrying capacity for humans in a region.

Resource availability in this environment dictates that hunting of large ungulates would be the mainstay of the economy, and especially the winter season economy, at any time during the Holocene. Given the low overall densities of game in this environment and the apparent tendency for large, natural fluctuations in game populations over intervals of 60-100 years (Wallmo 1981), the home range sizes of individual bands would be very large. Annual ranges of several thousand square miles are the norm for people who subsist on the hunting of large game in boreal forest environments (Rogers 1963). At least during the early Holocene when human population densities were relatively low, home ranges would have been very large and residential mobility very great. As long as competition for resources with neighboring groups is not a factor, the least-cost system of land use is one in which residential moves are very frequent. Inasmuch as hunting success rapidly declines with decreases in game densities, there is an advantage associated with frequent moves to areas not recently hunted. Small bands (25-50 persons) would move between resource "patches" which in this case would be those locations of winter game concentration. Owing to the mosaic-like character of good winter foraging range for ungulates that results from the interaction of fire, solar exposure, and slope, the distribution of optimal hunting locations would literally be in patches. Given few constraints upon group movements imposed by the presence of surrounding bands, an individual band might not return to a particular area for many years or even decades and there simply would not be a "seasonal round" as is known for many recent hunter-gatherers.

Any increase in the population/resource ratio brought about by actual population increase or by reductions in resources due to climatic change would begin to impose pressures to reduce the size of home ranges. Given that the initial ranges greatly exceeded the area covered within a single year, a considerable degree of range reduction would be possible without any significant change in the overall settlement strategy (Binford 1980). At some point, however, further reductions in range size could not occur without consequences for both subsistence and settlement strategies. It is at this threshold that resources previously exploited might be exploited in a different manner. Greater reliance upon controlled application of fire to maintain early seral stages of vegetation, as well as fishing, and plant collecting should all begin to expand in importance at this juncture.

Associated with these general trends in subsistence, there should be shifts in settlement. In general, the most dramatic settlement change correlated with the proposed intensification strategies should be a substantial reduction in the home ranges of human bands. Of particular importance for archaeological patterning is the theoretical expectation that reduction in the home range area would be associated with less frequent relocations of residence by individual local groups (Binford 1980). Reduction in this type of mobility, however, is expected to be accompanied by an increase in the sort of mobility that involves procurement of resources by individuals or task groups from locations beyond that distance which can be exploited from a base camp residence on a daily basis. In other words, there would be a measureable tendency toward more centripetal settlement systems though not nearly to the extent achieved by hunter-gatherers with heavy dependence on food storage. This reduction in residential mobility would be accompanied by development of a logistic zone (Binford 1980:17).

In light of the arguments offered above regarding the effects of burning on the amount of winter range for game, it is expected that winter would be the season in this environment when increased reliance on logistic procurement would occur. In other words, hunting task groups that go beyond the day radius might be effective in the winter given the degree of predictability in the location of game resources at this season and the potential to kill a number of animals and freeze the meat for delayed consumption. Rather than making residential moves to hunt in new areas or patches of winter range, a number of these ranges would be exploited logistically from a single residential camp. Hunting parties that met with success could easily cache quantities of frozen meat, return to their residential camps, ant then move the residential camp to the vicinity of the meat caches at a later time. Rogers (1963) describes this combination of residential and logistic strategies for the Mistassini Cree and it was used whan a quantity of meat was taken at a distance too great for transport back to a residential camp. Given the winter hunting conditions and game species characteristic of the study area, it is argued that a similar strategy might become a typical feature of aboriginal land use systems under conditions of intensified land use in this environment. Because winter season is the only season during which hunter-gatherers in this environment are likely to have any

success in accumulating food supplies in bulk, it is the only season for which there would appear to be any potential for increasing logistic elements of a land use system.

Arrival of the horse in this region in the early 1700s undoubtedly brought about still other and probably substantial changes in aboriginal land use. The major impact of horses would be to permit a significant increase in logistic mobility. Group sizes also tend to increase with any technological improvement in the distance covered per day by humans and/or in the weight that can be transported (Schalk 1978). Addition of horses would change the costs associated with procuring certain resources and would introduce new constraints on settlement imposed by the foraging requirements of horses themselves.

Expectations for Archaeological Patterning in the Project Area

Placing these proposed trends and changes into a time-frame is quite difficult at this point although it is known that the emergence of an equestrian land use system in this region can be placed after A.D. 1730 (Haines 1938). The proposed shift from extensive to intensive hunting is much more problematical; it is difficult to make a strong case for whether this change would come about gradually over many centuries or even millenia or whether the change would be more saltatory. One might argue that because the most pronounced environmental change involving probable reductions in food abundance occurred between 2,000 and 3,000 years ago with the development of a more closed forest, this is a likely interval in which to expect significant shifts in land use. Admitting that the resolution of this question is ultimately an empirical question, attention is now turned to a brief discussion of the kinds of evidence that would be useful in evaluating these ideas about prehistoric land use. Concern here is with identifying archaeological correlates that are expected if the preceding arguments have validity.

The preceding arguments about long-term land use changes can be used to derive expectations for preliminary testing with archaeological survey data. Any number of predictions about site location, structure, and content can be generated from this model but the discussion is confined here to a number of major patterns that are expected. These can be listed as follows:

(1) Given the physiographic setting of the project area, most sites encountered should be related to hunting in terms of site function. Site locational characteristics and assemblage content should reflect the dominant role of hunting. The distribution of most sites should be associated with those locations where game resources are concentrated during the winter season (e.g., locations with good solar exposure below 3,000 feet elevation).

(2) Most sites should reflect short term occupation and there should be no evidence for winter sedentism or lengthy intervals of occupation. High densities of materials on sites near locationally

stable resource procurement "patches" (e.g., south and west facing slopes below 4,000 elevation) should result from re-occupation of residential sites over long time periods rather than from lengthy intervals of occupation. This should be reflected in the wide temporal range of diagnostic artifacts on sites characterized by high densities of archaeological debris. Evidence for winter sedentism in the form of high investment domestic structures, storage facilities, or cemeteries is not expected.

(3) There should be evidence for increasing intensity of land use through time within the project area. This should be apparent in at least two ways--by greater variety in the seasons of occupation through time, and by high frequencies of residential sites up to the time that a slightly more logistic system is adopted; thereafter there would be fewer residential sites but more logistic or small special purpose sites.

(4) As intensity of land use increases through time there will be a trend toward more central location of residential sites. This trend should be evidenced archaeologically by higher frequencies of later residential sites occurring in settings from which multiple "patches" can be exploited from a single base camp. Given the terrain features of the study area, such locations will be near the mouths of major tributaries and especially those tributaries draining areas with extensive south and west facing slopes below 4,000 feet elevation. To facilitate exploitation of numerous tracts of winter range for large game from a single residential camp, preferred locations would also tend to be near the river and on lower terraces.

(5) There should be increasing evidence for the exploitation of fish and plant resources associated with the change towards a more intensive land use strategy.

CHAPTER 5

INVESTIGATIVE STRATEGIES

by

Alston V. Thoms

The archaeological survey and testing project for Libby Dam-Lake Koocanusa had two field oriented objectives: (1) a thorough inventory of archaeological resources in the project area; and (2) evaluation of the resources in terms of their potential scientific and/or cultural significance by means of surface collecting, mapping, and testing. Fieldwork was conducted in 1981 and 1982 during the annual reservoir drawdowns between March and May. Most of the 1981 effort was directed toward survey work, although several sites were surface collected and test excavated. During the 1982 field season, most activities centered on mapping, surface collecting, and subsurface testing, but a considerable amount of survey work also took place.

Evaluation of archaeological resources requires assessing their potential to yield information of scientific value. Toward this end a number of questions or problems have been identified and a general model has been formulated (see Chapter 4). The methods used to gather the information necessary to assess the model are described and discussed in the following sections. Survey, testing, and analytical strategies are discussed in the first three sections. The final section deals with limits and constraints regarding the investigative strategies.

Survey Strategies

All land surfaces between the minimum pool elevation of 2,287 feet (698 m) amsl and the maximum pool elevation of 2,459 feet (749.5 m) amsl, as well as a 30 m wide vegetated band bordering the full pool were scheduled for a systematic surface survey. However, because the 1981 and 1982 Lake Koocanusa drawdowns did not bring the pool to its minimal elevation, only those surfaces above 2,342 feet (714 m) amsl could be surveyed. The 0.5 mile wide survey tracts defined during the 1976 sample survey (Jermann and Aaberg 1976) were also utilized during the 1981 survey. These east-west oriented tracts were covered using the parallel transect system wherein individual surveyors were responsible for a 30 m wide transect and each walked a zig-zag pattern within a transect. Although it was stipulated in the statement of work that survey transects be walked at right angles to the reservoir margin, that procedure proved extremely impractical and even dangerous in many areas due to the very steep, often scree covered, slopes that are characteristic of various parts of the reservoir. In such areas it was necessary to walk the 30 m transects parallel to the shoreline. In certain locations, even that procedure was impractical due to

exceptionally steep reservoir margins. In those cases, the survey was restricted to walking the vegetated zone adjacent to the reservoir and the base of the steep slopes or cliffs.

All cultural materials encountered were either designated as sites or recorded as isolated finds. Sites were defined as concentrations of five or more cultural items, including fire-cracked rock (FCR), bone, and flaked and nonflaked lithics, within an area 30 m in diameter (approximately 707 m^2). Areas where cultural materials were not continuously distributed, but were concentrated and separated by more than 30 m were designated as individual sites. Cultural materials that occurred in frequencies of less than five items per 707 m^2 were defined as isolated finds. These conventions were adopted because: (1) the overall distribution of cultural materials was expected to be sparse, (2) small size sites were anticipated, (3) horizontal stratification within some localities was considered a likely possibility, and (4) the definitions seemed compatible with those used during the previous surveys (e.g., Jermann and Aaberg 1976).

Locations of sites and isolated finds were recorded on US Army Corps of Engineers (ACOE) topographic maps (scale 1":800'). Standard ACOE site forms were completed, and photographs were taken of each site. Typically, planview or rough contoured sketch maps were drawn for each site. Actual counts of cultural items by general type (e.g., flakes, tools, FCR, and bone) were made at most sites. However, at large and/or high artifact density sites, the number of items was estimated. A basic no-collection policy was maintained during the 1981 survey. Exceptions to the rule included isolated finds and projectile points, as well as total collections made at very small sites judged to be difficult or impossible to relocate and those considered to be in imminent danger of destruction. The underlying rationale for the survey's collection policy was that more informed decisions regarding the kinds of artifacts and sites to collect could be made in the light of postsurvey evaluations of the diversity and character of all known cultural resources.

All accessible areas within the reservoir were surveyed between March 11 and April 7, 1981. The 16 person field team was divided among four crews, each supervised by a crew chief and operating within survey tracts that were assigned on a daily basis. To enhance consistency in survey and recording methods among crews, the project supervisors and crew members were rotated regularly. Depending upon site density as well as access, terrain, and weather conditions, individual survey crews covered from two to six, half-mile wide transects per work day.

The 1981 survey located a total of 117 sites, 96 of which had not been recorded previously. Of the 117 sites, 92 contained only aboriginal artifacts, 15 had historic nonaboriginal materials, and 10 contained both aboriginal and nonaboriginal materials. In addition, a total of 24 isolated finds was recorded. A number of the previously recorded sites could not be relocated because they were innundated, buried under recent sedimentary deposits, or had been so eroded as to render them unrecognizable. All of the 1981 sites and isolated finds

Most artifact cleaning, cataloging, and labeling, and processing of water screen samples, as well as site and excavation form processing, took place in the field laboratory. As a rule, the materials recovered during one day's field work were processed on the following day by a three-person lab crew. In addition to efforts of the lab crew, field crews also spent time working in the lab when inclement weather prohibited fieldwork. With this additional labor force, lab work generally kept pace with fieldwork. Thus, project personnel had access to updated tabular information regarding the number and material types of items in each general artifact category. This kind of information was most useful in planning the course of fieldwork.

In the field lab, level and surface collection bags were sorted and checked against the field records prior to artifact washing. Once cataloged and labeled, each tool (e.g., bifaces, unifaces, edge modified flakes, ground stone) and core was placed in a plastic ziplock bag labeled with all provenience information and the artifact number. Flakes, chips, and shatter were washed and cataloged, but not individually labeled. Rather, all items in these debitage categories (from the same collection unit) were assigned the same artifact number and stored in appropriately labeled ziplock bags. Faunal material and fire-cracked rock were processed in the same manner as flakes, chips, and shatter. All water screen samples were washed through 1 mm mesh mosquito netting. The noncultural matrix was separated and discarded; cultural materials were sorted into artifact, floral, faunal, and charcoal groups and processed like materials recovered from the 1/4 inch screen or the surface.

Site, excavation, and surface collection forms as well as artifact bags were checked by the lab crew for the necessary information. Inconsistencies and inaccuracies were corrected by the appropriate crew chief. Once completed, site forms were submitted to the state clearing house at the University of Montana.

More extensive analyses of recovered items were conducted following the 1982 field season. The descriptive approaches for flaked and nonflaked lithic artifacts, those for faunal remains, and those for historic, nonaboriginal artifacts are discussed separately in the text. In general, all formal tools were described according to selected metric attributes (length, width, thickness), type of raw material, and certain technological attributes including extent and placement of flaking, grinding, or battering. Projectile points were described in more detail. Fire-cracked rock was generally described in terms of size, weight, and material type and in some cases according to type of fracture pattern. Faunal material was described according to taxon, skeletal element and portion thereof, number, weight, breakage, and modifications (e.g., burned, cutmarks, weathering). Historic items were described according to their general and specific functions, material type, and condition.

All cultural materials recovered during the course of this project as well as supporting documentation (e.g., photographs, maps, fieldnotes, etc.) are to be housed at a Montana institution. A large

using the transit/stadia technique. For smaller, less complex sites, the compass/tape or pace measurement technique was used. The maps illustrated contour lines as well as the location and orientation of all structures and features. Generally, historic artifacts were collected using the point provenience technique, but in several cases artifacts were collected from shovel skim and "dog leash" units.

Summary of Survey and Testing Strategies

A variety of survey and testing strategies were employed during the project. The primary goals were to understand the range of cultural resources variability in the areas and to retrieve a reliable sample of materials that reflect the observed variability, thereby providing the basis for testing models of land use. The inventory level survey of the denuded landscape provided an unparalled opportunity to document the distribution of cultural resources in a forested and mountainous environment. Due to a variety of circumstances, most important of which were the near-surface and exposed nature of cultural materials, there is considerable confidence that the systematically judgmental testing approach yielded a sample of materials that adequately represents the observed variability of extant cultural resources in the project area.

Aboriginal artifacts were retrieved from 119 sites, some of which were collected using several techniques. Limited point provenience and grab samples were recovered from the surface of 64 sites. Partial grid unit and/or "dog leash" samples were collected from 15 sites, and the samples are considered to be representative of the materials present at the sites. All cultural materials except FCR were collected from the surface of an additional 47 sites, using a variety of techniques. A total of 14 sites were tested using 1 x 1 m or larger excavation units as well as by exploratory excavation and probe units. An additional 30 sites were tested by exploratory probe and/or excavation units. Subsurfaces of 13 sites were examined only through exploratory probing. Five historic (i.e., nonaboriginal) sites were mapped in considerable detail. Appendix B provides a listing of the types of surface and subsurface investigations undertaken at each site, as well as a tabulation of the representativeness of the collection from each site.

Analytical Strategies

As with all other aspects of the investigative strategies, analyses were directed toward addressing the stated research questions. The artifact description portion of the analysis was more exhaustive than required to address the research questions, but it permits future and more detailed comparisons with materials recovered from other sites in the region. In general, the analyses were directed toward generating enough information to assess the area's cultural resources in terms of National Register criteria. More comprehensive and exhaustive analytical approaches were considered appropriate to mitigation level investigations as opposed to survey and testing efforts.

knolls, saddles), and the edges of the landform where most material tended to be concentrated, as well as to sample the surface features (e.g., FCR and bone concentrations). Most exploratory excavation units were .5 x .5 m in size and depths ranged from .5 to 2 m. Post hole diggers were used to reach depths greater than 1 m. Exploratory excavation units 1 x .5 m in size were frequently used to bisect FCR or other features, the objectives being to recover a sample of materials and to determine whether or not the concentration represented some kind of pit feature. Exploratory excavation units were also used in conjunction with shovel skim units. In those cases, a 1 x 1 m unit was laid out over a FCR feature; half of the unit was shovel skimmed and half was excavated.

The northwest corner of the unit served as the datum, and excavation followed the ground surface in 10 cm levels. All matrix was screened through 1/4 in hardware cloth and a constant volume (4 l) sample for water screening was collected from each 10 cm level. As a rule, excavation continued either through three sterile levels or until sediments not conducive to human occupation (e.g., lacustrine or fluvial sands) were encountered.

Bank profiles also were considered a type of exploratory excavation unit. The slump and matrix from preparing the profile were screened through 1/4 in hardware cloth. Bank profiles were prepared infrequently and only where natural cutbanks were readily available and required a minimal effort to clean. They were used primarily to examine the nature of the sediments and assess the probable depth and nature of cultural materials.

Test Excavation Units

Test excavation units were simply a more extensive version of exploratory excavation units. Most test excavation units were at least 1 x 1 m in size, but they were as large as 2 x 2 m. Excavation units were used primarily at sites where the recovery of large numbers of artifacts was expected and where the nature of sediments (e.g., rocky fan or debris flow deposits) dictated that units be larger so as to facilitate removal of the matrix, or where the size of the feature being tested required the use of large units. The same procedures were used in excavating test units as were used for the exploratory excavation units.

Historic Site Documentation

Historic sites recorded during the 1981 and 1982 field seasons were documented on survey forms in the same manner as were aboriginal sites. Several sites were mapped and/or collected in greater detail, as stipulated in the scope of work. Structural remains were described according to their mode of construction, condition, and probable function. Each feature or structure was measured and its orientation was recorded. In the case of larger sites, the site map was prepared

Shovel Skim Technique

Earlier it was noted that postreservoir sediments frequently formed a thin mantle over sites or parts of sites and effectively obscured smaller items such as flaked lithics and bone fragments. When this situation was suspected, a specialized surface collection technique involving shovel skimming was employed. Lines of contiguous 1 x .5 m units were laid out over different parts of the sites. Typically, lines of shovel skim units were laid out on the flat and sloping parts of the site, as well as on other topographically distinct areas (e.g., small knolls and saddles). Emphasis was placed on sampling the outer edges of the landforms where materials tended to be concentrated. Up to four 8 x .5 m lines or shovel skim trenches were dug at sites. Shovel skim units were also used within "dog leash" and grid units in those situations where it seemed that the smaller objects could be underrepresented on the surface. Within the shovel skim units, postreservoir deposits and several centimeters of prereservoir sediments were removed by skimming away this upper mantle of sediment. The sediments were screened through 1/4 in wire mesh and a constant volume sample (4 l) was taken from each 1 x .5 m segment of the trench. Constant volume samples were water screened through 1 mm mesh mosquito netting to recover small items of interest (e.g., flakes, charcoal, floral and faunal materials).

Exploratory probes

Several exploratory probe techniques were employed as a means to assess the nature of subsurface deposits and estimate the horizontal extent of shallowly buried cultural materials. Exploratory probes were also useful in determining the placement of larger excavation units. The most commonly employed techniques were trowel tests and shovel tests about 30 cm in diameter and up to 25 cm deep. These were designed to penetrate the postreservoir deposits and examine several centimeters of the prereservoir sediments. The matrix was either carefully examined with a trowel or screened through 1/4 inch hardward cloth. Post holes (20-30 cm in diameter) and auger holes (each 8 cm in diameter) were also used as a rapid means of assessing the nature of sediments and possible depth of cultural materials. The matrix from post holes and auger holes generally was removed in 10 cm increments and screened. Another probing technique was to trowel through and examine clumps of sediments and the edges of pits associated with tree-throws in search of cultural material. This technique was employed in the vegetated areas along the reservoir margin where tree-throws were common.

Exploratory Excavation Units

Exploratory excavation techniques were designed as a means to estimate the vertical extent and integrity of cultural materials, as well as to determine whether or not more extensive test excavations would be likely to yield substantive results. Exploratory excavation units were smaller than the 1 x 1 m test excavation unit. They were placed to sample the intrasite topographic variability (e.g., flats,

Several different surface collection techniques were employed during the 1982 field season. The point provenience technique was the most common. This was done by recording the location of the collected artifact in terms of its distance (tape and paced measurements) and azimuth (read from a hand-held compass) from a known point on the site grid. In general, if there were fewer than 50 items on the surface, all were collected. At those sites where artifact densities were high, all tools were collected using the point provenience technique and selected areas were sampled to recover a portion of the debitage using grid unit techniques.

Grid unit collections were used at a number of sites where concentrations of artifacts were apparent and much less frequently where the distribution of lithic artifacts was evenly distributed across the site. That portion of the site scheduled for grid collection was subdivided into 2 x 2 m grid units. These blocks of units ranged in size from 4 x 6 m to 4 x 40 m, depending on the size of the concentration area. All material from each 2 x 2 m unit was bagged separately. During the early part of the project FCR was counted and weighed prior to removing the rocks to an off-site location. Sometimes the counts, weights, etc., were made at the field laboratory. Raw material types usually were recorded. Later in the project, FCR was retained for subsequent analysis.

At sites with comparatively smaller areas of artifact concentrations and where the objective was to recover all items in immediate proximity to FCR features, the "dog leash" surface collection technique was used (Binford 1964). "Dog leash" collection units could be established much quicker than grid units and as such were viewed as more efficient means of sampling some sites. This technique entails selection of a point within the artifact concentration or near the center of the FCR feature; that point serves as the center of a circle around which the circumference is scribed. Depending upon the size of the artifact concentration or feature sampled, the radius of the "dog leash" unit was either 1.15 m (roughly equivalent to a 4 m^2 area) or 2.25 m (roughly equivalent to a 16 m^2 area). The larger "dog leash" units were subdivided into quarters, each of which approximates the size of a 4 m^2 grid unit. As with other collection units, all material from within the "dog leash" unit (or one-fourth of the large units) was bagged and labeled separately.

The areas between clusters of flaked lithics and FCR features were also sampled in a similar fashion as a means to enhance the representativeness of the sample. At sites, where the number of artifacts between clusters and features was very limited, the items were collected using the point provenience technique. In some cases, especially where artifacts appeared to be in place, a "dog leash" unit was placed around a point provenienced artifact. This was done in anticipation of analyzing the relationship between formal tools and other spatially associated artifacts. Fire-cracked rock from "dog leash" units was treated in the same manner as from the grid units.

compiled by Corps of Engineers personnel from aerial photographs. The grid was superimposed on the contour map by referring to aerial targets placed over site datums and grid unit intersection points. This technique also resulted in the production of a comprehensive map.

General site maps were compiled by the testing crew. In effect, these maps were detailed sketch maps compiled for less extensively tested sites. Mapping consisted of establishing a grid system by laying out base and datum lines with a hand-held compass. Distances were tape measured. Elevations were not measured; rather, 1 m contour lines were visually estimated and drawn so as to depict the general landform. The locations of artifacts, features, collection units, etc., were recorded in relation to the grid system or by distance and azimuth from the site datum.

Corps of Engineers blue line maps (1 in:400 ft) were reproduced and used in several instances as base maps to illustrate the locations of individual sites that occurred in close proximity. These groups of sites in the same general area (e.g., at creek mouths, on large dunes, or on dissected terraces) were referred to as site clusters.

Surface Collection

Total grab sampling was done at 11 sites that had only a small number of items as well as at several severely deflated sites where none of the artifacts could be considered in situ. Limited grab samples were recovered from numerous other sites, especially during the 1981 season. Recovery of artifacts and maintenance of intrasite provenience by numbered grid unit is termed the grid unit collection technique. Total grid collections were recovered from nine sites during 1981. These sites were selected for one or more of the following reasons: (1) to provide an adequate sample for interim analysis; (2) to sample sites with primarily flaked lithics as opposed to FCR; (3) for assemblage comparisons among sites suspected to have different roles within the settlement system(s); and (4) for assemblage comparisons among sites within a single cluster. Collection procedures at the nine grid collected sites involved the establishment of a grid system. In most cases, artifactual materials were collected within 2 x 2 m units, but at several sites where artifacts were clearly displaced from their original location by erosion or downslope movement, the grid size was increased to 10 x 10 m units. Within each grid unit, all cultural materials (except FCR) was collected and placed in labeled bags. All FCR was counted and weighed, then removed from the site area for disposal.

Through the above procedures, all cultural material visible in 1981 was removed from the surface of the following sites: 24LN364, 24LN365, 24LN366, 24LN427, 24LN1054, 24LN1058, 24LN1060, 24LN1073, and 24LN1074. Future drawdowns would permit an evaluation of the nature of erosion and exposure of buried cultural materials. This information proved useful in assessing the effects of reservoir waters on the sites. In the early spring of 1982 all total grid collected sites exhibited considerable quantities of cultural materials. This indicated that erosion was occuring at a fairly rapid rate even over a period of less than one year.

Several techniques were used to test, that is, to collect information from sites, but the standard approach was similar at all sites. It began by laying out a grid over each site and making a 1 m contour interval map. Next all cultural materials were marked with color coded wire flags, except where densities were very high, and then only concentrations, features, and obvious tools were marked. Various kinds of collection techniques were used to recover reasonably representative samples of artifacts exposed on the surface. If postreservoir sediments obscured the suspected artifact distribution shovel skim units (see next section) were excavated. Small, exploratory probes (ca. 30 cm diameter) generally were dug to determine whether or not intact sediments were present and as means to assess the horizontal extent of materials obscured by postreservoir sediments. Exploratory excavation units (ca. .5 x .5 m) were dug to assess the potential for depth and quantity of buried cultural materials. The most intensive collection technique employed was test excavation using 1 x 1 m or larger units. This technique was used at only a few sites where cultural materials were known or suspected to be present at some depth or where features were expected to yield considerable quantities of materials.

Site Mapping

Most tested sites were mapped by a mapping crew. As a rule, the landform or that part of it upon which the site was situated was mapped prior to the arrival of the testing crew. One of two basic kinds of maps--comprehensive or general--was drawn for each tested site, depending upon the circumstances. Various techniques were used to complete the two kinds of maps.

Comprehensive site maps were compiled for all extensively tested sites. These were made using either the transit/stadia or Brunton compass (tripod mounted)/handlevel methods, depending on site accessibility. At least one semipermanent datum point (i.e., the 50 cm long, 3/4 inch in diameter, galvanized conduit pipe) was established at each site. Datum (oriented magnetic north-south) and base (east-west) lines were established within the suspected site limits. Grid stakes were placed at 20 m, tape-measured intervals in such a manner as to facilitate expansion of the grid system as necessary by the testing crew. Expansion and subdivision of the grid system were done with measuring tapes using the triangulation method. Elevation shots were taken from grid points and other locations as necessary to produce a 1 m contour map. Generally, two tie-in points were also established. They tended to be sturdy tree stumps or blaze marks on live trees. These were marked with a bridge nail and labeled with an embossable aluminum tag. Site maps were compiled in the field laboratory and once completed they were field checked for accuracy of topographic information and locations of excavation units, etc. Additionally, placement of site boundaries, features, artifacts, etc., were verified by the crew chief responsible for the site.

For several of the 1981 grid collected sites, the grid was established using the transit/stadia method, but the contour map was

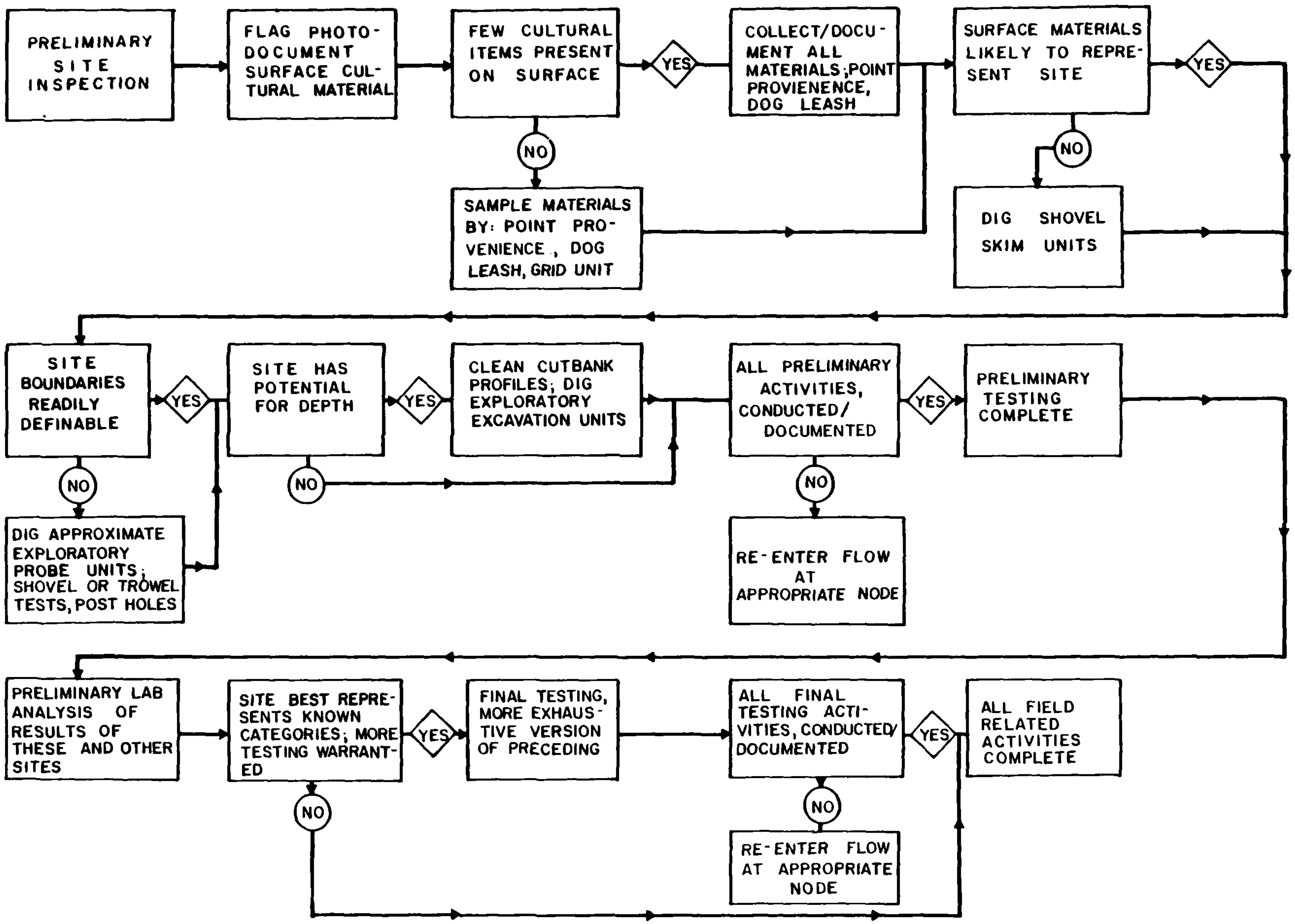


Figure 5-2. Decision flowchart used to determine sequence of investigative strategy at each site.

that would otherwise have been gained only after a substantial amount of subsurface excavation and subsequent analysis.

In a sense, reservoir-caused erosion already had done much of the excavation. Conditions ranged from sites that had been stripped of only a few centimeters of organic overburden to those that had been eroded to lacustrine sediments. Information usually gained only through excavation could be acquired by examining the denuded site surfaces. Examples of those kinds of information include the following:

(1) the effects of logging, clear cutting, and erosion on the site; this varied greatly;

(2) the type of landform and its depositional context, knowledge of which permitted assessment regarding the possible depth of cultural materials; in most cases materials were surficial or near the surface;

(3) the types and densities of artifacts and features present at the site; this was highly variable; and

(4) the horizontal distribution of cultural materials; materials tended to be concentrated along the edges of landforms.

Information also became available concerning areas and landforms where surficial characteristics were not likely to indicate the nature of the subsurface. These conditions were particularly prevalent in dune settings and to a lesser degree on fans, deltas and debris flows.

Given the known range of variability in site conditions it was reasonable to tailor testing methods and techniques to fit individual sites. A judgmental testing approach was considered to be more appropriate than either a random collection approach or some other approach that required surface collecting or subsurface testing of the same proportion of all sites. In other words, it seemed as if there would be a higher return on time and energy investments if systematically judgmental criteria were employed to decide where and how to test each site. Obviously, the high degree of surface exposure at most sites greatly aided the decisions about testing.

The judgmental testing approach was systematic in that an attempt was made to address the same questions and recover the same general kinds of information from each tested site. To insure a judgmentally systematic testing approach, a kind of decision node flowchart (Figure 5-2) was used to determine the most appropriate methods and techniques for each site. Because of the repeated positive correlation observed between the location of fire-cracked rock (features and scattered) and other kinds of artifacts, such as flaked lithics, nonflaked lithics, and bone, collection efforts focused on FCR features. Areas that exhibited concentrations of other kinds of artifacts such as bone and flaked lithics were also sampled or totally collected. Areas between artifact concentrations and features also were examined and collected or test excavated.

most cells. For example, the same cell could contain large and small size sites with various quantities of material, buried and surficial sites, relatively intact and severely disturbed sites, as well as sites situated on different parts of the landform and with different solar exposures. Within any given cell, relatively intact sites representing the various solar exposures, time periods, positions on landforms, and size categories tended to be selected for testing. By the end of the project, total collections or grid unit collections considered representative of a site had been recovered from all but 5 of the 31 cells that contained aboriginal sites available for testing. Of the five cells without total or grid collected sites, there are only two cells that contain sites from which no collections were recovered.

The specific testing strategies were intended to provide information necessary to make the following assessments: (1) horizonal and vertical extent of the site; (2) the presence or absence of features; (3) site integrity; (4) artifact variability and distribution; (5) presence or absence of cultural stratigraphy; (6) depositional context; (7) cultural affiliations; (8) chronological affiliations; and (9) immediacy of destruction or loss of the site. Contractual stipulations, in addition to the inventory, required the following: (1) recover grab samples (i.e., collection without maintaining intrasite provenience) from 50 sites; (2) make grid unit collections at 15 sites; (3) conduct shovel/auger tests at 30 sites; (4) excavate 1 x 1 m test pits at 10 sites, with the area excavated not to exceed 0.5 percent of the total site area; and (5) map three historic sites (US Government 1981a:11).

During the first field season, 15 sites were grab sampled, 9 were grid collected, and 6 were tested with 1 x 1 m test pits or shovel and auger tests. The results of preliminary analysis of the recovered materials from the tested sites provided considerable information about the general nature and distribution of materials, as well as some ideas regarding their depositional context. Most cultural materials were confined to the upper 40 cm of deposits, but at some sites they extended to depths as great as 80 cm. In some cases reservoir erosion had removed more than 100 cm of the prereservoir sediments. The number of flaked lithic artifacts on the surfaces of these somewhat eroded sites ranged from fewer than 10 to more than 15,000, but most sites had fewer than 200 artifacts. Fire-cracked rock (FCR) was also very common in clusters and scatters. In general there was a positive correlation between the number of FCR and the number of flaked lithic artifacts.

During the first few days of the second season's field work, efforts were directed toward a general reconnaissance of the area and familiarizing the supervisory staff with project-specific field methods and techniques. Emphases were placed on understanding the environmental and depositional dynamics as well as experimenting with various surface and subsurface collecting techniques. The fact that the project area was primarily the drawdown zone of the reservoir provided an unparalleled opportunity to see the landscape stripped of its vegetation and organic ground cover. In a very short period of time it was possible to achieve an understanding of sediments and site structure

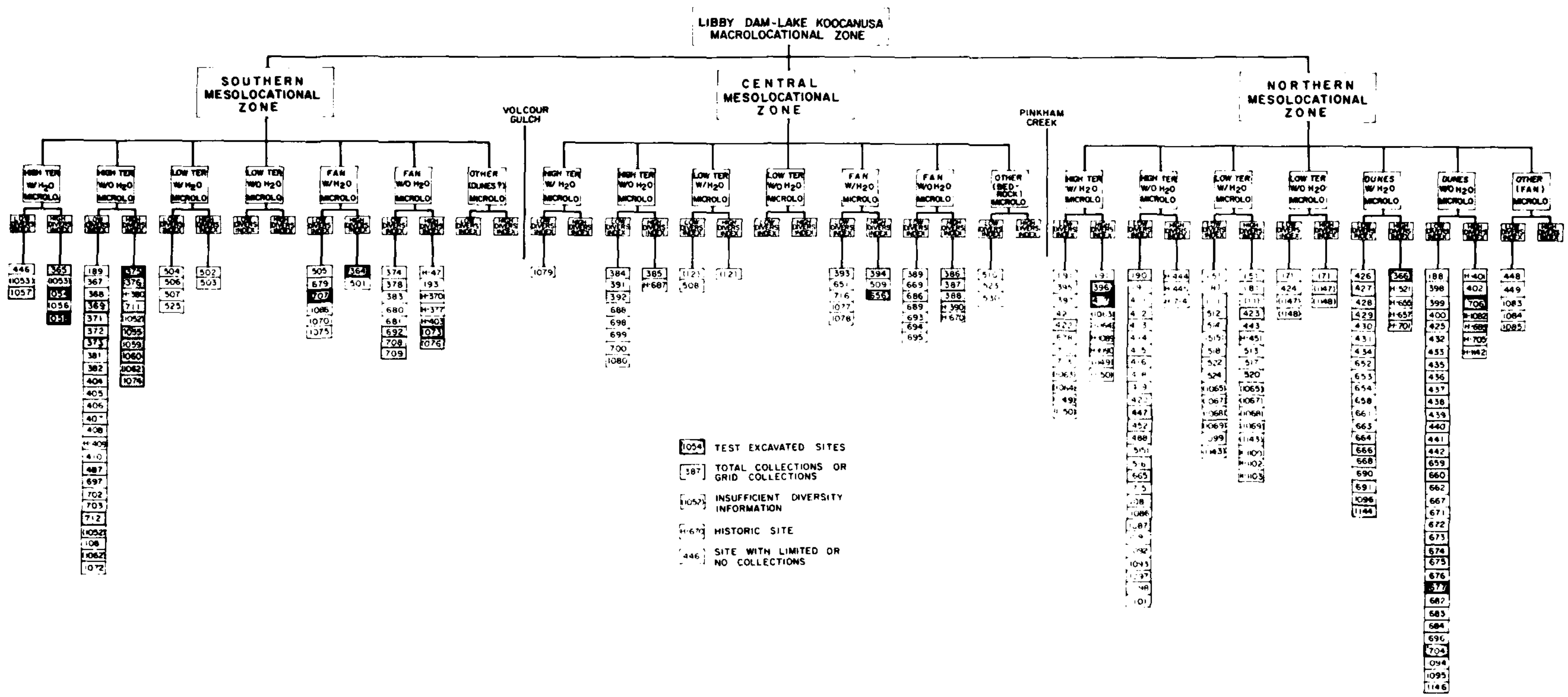


Figure 5-1. Classification scheme used to determine which sites should be tested and/or subjected to detailed surface collection. Test excavated refers only to those sites subjected to full scale testing, (i.e., excluding sites tested with auger, trowel or post holes and those tested only with pits smaller than 1 x 1 m).

previously unknown sites and 22 isolated finds were recorded. Of the 62 sites, 38 contained only aboriginal cultural materials, 5 had only nonaboriginal or historic artifacts, and 19 exhibited both aboriginal and nonaboriginal artifacts. Most of the sites were documented in areas that had been surveyed in 1981, particularly where erosion during the intervening year was very evident.

Testing Strategies

During the course of the project an attempt was made to examine the range of variability in site types and location throughout the study area. This was approached in part by selecting and testing (i.e., sampling) a number of known sites in the study area considered to represent the range of variability as it was understood at the time the sample was selected. Efforts to understand site variability were directed toward illustrating: (1) the distribution of sites in terms of available foraging space (i.e., the area of land within 5 km radius and below 3,000 feet elevation surrounding a site); (2) the relationship between sites near to and those away from permanent water sources, but on similar landforms; and (3) the cultural material content. It was felt that these lines of inquiry would be useful in addressing questions of resource distribution, seasonality of occupation, and site function and/or intensity of use. The framework for both illustrating the range of variability according to the aforementioned criteria and for selecting representative sites for testing was a stratified classification system. In the system, each site was initially classified according to multi-tiered criteria (Figure 5-1). The tiers or classification strata were as follows: (1) macrolocational, encompassing all sites in the reservoir area; (2) mesolocational, classifying sites according to their placement in one of three valley segments defined in part on the basis of available foraging space; (3) microlocational, classifying sites according to their setting on one of four landform types, either with or without a nearby permanent water source; and (4) cultural material content, classifying sites according to whether they had a high or low diversity in the types of recorded artifacts. All known sites, including those located by Shiner (1950) and Taylor (1973) were included on the chart. This scheme yielded 42 distinct cells or potential site type categories, but 16 of these did not contain sites and several other cells only contained sites not accessible during the field season because they were inundated. As new sites were discovered during survey work they were added to the chart. It often was necessary to reassign sites to other cells because their content changed as new artifacts were discovered during testing or analysis or following a second visit. Thus, the results of the classification scheme were in a continuous state of flux and were finalized only after completion of all fieldwork and analysis.

Ideally, the goal was to test or at least have a reasonable sample of material from one or more sites in each of the identified cells. Selection of sites for testing was done on a judgmental basis because there was still a considerable amount of variability represented within

distribution patterns, trowel tests were made at approximately 10 m intervals along the transects. These tests were small holes (ca. 30 cm in diameter) dug with a trowel to expose the prereservoir surface deposits likely to contain cultural materials. The prereservoir surface, often marked by a layer of decomposing organic matter, was examined by troweling through several centimeters of inorganic sediments in search of cultural materials. When artifacts were encountered using this technique, a larger area (ca. 1 m in diameter) was cleared of postreservoir deposits and other trowel tests were made at 5 m increments along four lines at right angles to one another in an attempt to discover additional material and define site boundaries. While only four sites were discovered using this technique, it did prove to be a reasonable and practical way to deal with obscured surfaces. The technique is similar functionally to leaf mat clearing in forested areas and to shovel "turn-overs" in areas covered in grasses or cultivated crops.

When a site was discovered during the normal course of the survey, the area was carefully examined and all cultural material was marked with color coded wire flags (e.g., red for flaked lithics, white for FCR, blue for bone, etc.). The color coded wire flags were useful for several reasons: (1) they graphically illustrated the limits of surficial cultural material; (2) they illustrated the clustering of particular kinds of materials; and (3) they provided a means to quickly assess the general nature and distribution of cultural materials.

When site limits had been established, a datum stake was placed in the central portion of the site. A galvanized metal conduit stake, about 0.5 m in length served as the site datum. A labeled embossable aluminum tag was placed inside the upper end of the stake as means of identifying the site. It was labeled with the site number (frequently, the field number that indicated the survey tract and preliminary site number) and the designation "COE/WSU 1982, Site Datum." The site datum not only served as a reference point for subsequent mapping, but also as a semi-permanent marker to be used in relocating and reassessing the site at later points in time.

A sketch map was drawn of the site area, and it usually included approximate 1 m contour lines and the location of artifacts, features and concentrations as measured by distance (paced or tape measured) and azimuth (compass bearing) from the site datum. Efforts were made to collect all tools and cores as well as a sample of the various kinds of lithic materials and, if present, readily datable historic items. On very large sites only the concentrations of materials and features were plotted on maps and estimates were made for the densities of the various kinds of artifacts and features. Occasionally, all of the flaked lithics were collected from small sites with relatively few artifacts. During the course of the 1982 survey, numerous previously recorded sites were revisited, datums were placed to mark their locations, and in some cases the sites were partially collected.

Approximately 40 person days were devoted to 1982 survey work, most of which was conducted by two-person survey teams. A total of 62

were located above the 2,350 feet (716.3 m) elevation--the minimum pool level at the maximum 1981 reservoir drawdown. Thus, survey work was not done on the first (T1) through the third terraces (T3) nor on major portions of the fourth terrace (T4).

The original objective of the 1982 survey was to inventory exposed areas below the 2,350 feet (716.3 m) elevation since it was forecasted that the 1982 drawdown would be about five m greater than in 1981. However, the 1982 drawdown was only 2.5 m greater than the 1981 drawdown. In other words, only those areas above the 2,342 feet (713.8 m) elevation were available for an inventory level survey. The only newly exposed area of any extent was in the northern (i.e., Kootenai Flats portion of Tobacco Plains zone) part of the reservoir and there sediments remained saturated with water and not conducive to survey work. Elsewhere, the newly exposed areas were primarily scree covered slopes and the slopes between terraces. In general only part of T4 was exposed; T1, T2, and most of T3 remained innundated or too wet for effective coverage.

Under these circumstances, 1982 survey efforts were redirected toward inventorying the few newly exposed and practically accessible T4 surfaces as well as a reexamination of areas that according to the working model should have had sites, but where none were found in 1981. It was anticipated that erosional processes expose sites in numerous areas where they had been obscured previously.

Survey strategies during the 1982 season were modified versions of those used in 1981. Modifications were necessary in the light of 1981 field experiences and related concerns. The modified approach was conceived as a means to compensate for several factors that were not necessarily unique to the Libby Reservoir, but that did appear important when designing survey work in a drawdown zone. These factors were as follows: (1) the moisture content of sediments, postreservoir aeolian deposition, and erosion varied to such an extent that sites visible one day could be totally obscured the next day; (2) the visibility of individual artifacts and features at sites also varied greatly from day to day; (3) postreservoir deposition tended to obscure small artifacts, with the result that often only FCR or other large items were readily visible; (4) some sites have been totally destroyed as a result of reservoir related erosion; (5) it was often very difficult to relocate sites in complex topographic settings, such as dune fields, and highly dissected terraces; and (6) the effects of intensive and extensive relic hunting and off-road vehicle recreation activities devastated numerous sites in the reservoir area. The standard operating procedures for the 1982 survey are discussed in the following paragraphs. It should be noted, however, that there was some variation in the approaches at specific sites.

The width of individual survey transects was reduced from 30 to 20 m and special attention was given to all cutbank exposures in an effort to increase the chances of detecting small sites with few artifacts. In those areas where postreservoir sediments covered 95 percent or more of the prereservoir surface and where sites were anticipated based on known

amount of descriptive information and computer generated data not used directly in this report is included with these materials. Although utilization of these materials is in many respects beyond the scope of this project these data should be most useful during the course of future mitigation level investigations.

Limits and Constraints

The authors have considerable confidence that the data generated as a result of this project adequately represent the observed variability of extant cultural resources in that portion of the reservoir examined and in terms of the research goals. Even so, it is recognized that there are both preexisting and self imposed limits and constraints that affect overall interpretations.

Several of the preexisting conditions, such as slow rates of sediment deposition, poor conditions for floral/faunal preservation, bioturbation, and cryoturbation, are natural ones. These conditions alter the context and nature of cultural remains and render certain interpretations of the archaeological record most difficult. To some degree, these conditions limit the kinds of specific questions that can be addressed readily (e.g., those related to specific diets and detailed cultural stratigraphy), but they do not have an overly adverse effect on most of the questions regarding land use patterns.

An important preexisting condition that limits understanding of past human behavior in the reservoir area is the fact that land surfaces below an elevation of 713.8 m (2,342 ft) have not been inventoried systematically for cultural resources and only a small numer of lower elevation sites have been tested. As a result, knowledge about the lower elevation sites is rather limited. This situation can be corrected partially by implementing a survey and testing project when the reservoir is drawn down to the minimum pool level of 2,287 feet (698 m) amsl. Fortunately, however, there are data on lower elevation sites immediately below Libby Dam (Roll and Smith 1982; Rice 1979; Choquette 1978).

Logging, clearcutting, and the razing of historic structures, as well as extensive erosion and deposition related to reservoir maintenance have also constrained and limited the possibilities of interpreting the archaeological record. On the other hand, reservoir-caused erosion has allowed access to a narrow "window" into regional archaeology by exposing a large number of sites that typically remain undetected during the course of survey and testing projects in montane forests. One thing that has been learned is that it is possible to lessen the devastating effects of reservoir caused erosion, and for that matter pot hunting, by sampling (i.e., testing) sites soon after they are exposed. If a newly exposed site is not sampled soon after it is exposed the combined effects of the actions of water, wind, and human agents are likely to disturb severely or destroy the site before it can be assessed.

The constraints caused by widespread relic collecting activities and the extensive use of off-road vehicles in the drawdown zone have affected the ability to interpret the archaeological record adversely and unnecessarily. This is because pot hunters are most interested in and collect projectile points, mauls, pestles, other finished tools, beads, coins, and bottles. These are the artifacts most useful in assessing chronological affiliations and site function and it is expected that diagnostic artifacts have been collected from many sites. An obvious result is that many sites are classified as "unknown aboriginal" when otherwise they could have been placed within a chronological or functional framework. The limitations caused by relic collectors are significant, particularly because there are very few opportunities to obtain absolute dates (i.e., C-14 or archaeomagnetic) for sites in the drawdown zone. Off-road vehicles that traverse sites also destroy the integrity of cultural materials, particularly features. This reduces chances of demonstrating spatial relationships between artifacts and features and within features, thereby destroying some of the sites' potential to yield significant information. Relic collecting occurs throughout the the reservoir area, but it, along with use of off-road vehicles, is most common in the northern zone.

Self-imposed constraints are not considered to be as limiting as are preexisting ones. Self-imposed constraints are related to the decisions regarding the kinds of investigative strategies utilized. Ideally, it is advantageous to have samples that can be demonstrated statistically to represent the cultural resources in a given universe, whether it be a site or an area. The systematically judgmental testing scheme employed here renders rigorous statistical approaches and tests of significance difficult at best. In other words, it would be difficult and time consuming to demonstrate that the sample of materials is statistically representative because a variety of approaches were employed and different proportions of different sites were collected/test excavated. Nonetheless, there is every reason to believe that the sample of recorded sites and recovered cultural materials adequately represents the range of variability. This is because generally the field team was able to observe the archaeological manifestations directly at a given site and judgmentally determine, with considerable accuracy, the kind of sample required to "represent" it. Since the majority of cultural materials were visible from the surface at most sites, there was a much higher probabilty of judgmentally recovering a "representative" sample from the area than there would have been had if it had been necessary to excavate to comprehend the variability. Given this situation, a rigorous, stratified random approach (cf. Mueller 1975), could well have yielded more statistically reliable data, but if implemented it would require much more time and would have sampled a much smaller percentage of the area's sites. Thus, there would have been less of a chance to represent the overall, reservoir-wide range of variability. Furthermore, the recovered samples might not have been large enough for statistical reliability.

Primary interest at the analytical level is to assess land use patterns as opposed to specific intrasite variability. Consequently, attention was focused on gathering and analyzing as much of the

appropriate kinds of information as possible, given the limitations imposed by available time and money. Even so, it is argued that at a general level the sample permits examination of questions relating to site structure and even specific problems such as lithic technology, but analyses of those kinds must await future studies conducted in conjunction with mitigation efforts.

CHAPTER 6

THE GENERAL NATURE AND DISTRIBUTION OF CULTURAL RESOURCES

by
Alston V. Thoms

A total of 249 sites and 46 isolated artifact finds has been recorded within the reservoir area (Figure 6-1). Of the total number of sites, 27 are classified as nonaboriginal or historic sites, 53 exhibit both aboriginal and historic artifacts, and 169 are attributed to aboriginal occupations. Results of the investigative strategies employed in the 1981-1982 survey and testing project provided a data base that adequately represents the main characteristics and distributional patterns of cultural resources within the intensively surveyed portion of the drawdown area. While all known sites have been included in the analysis, the information gathered from the sites located above 2,342 feet amsl is considered to be more exhaustive and reliable than that for sites below that elevation. Thus, the results are broadly applicable to the reservoir as a whole, but less confidence is assigned to the representativeness of data from lower elevation sites recorded earlier.

This chapter is divided into six sections. Each provides a brief discussion and presents summary data that characterize different aspects of the area's cultural resources. The first section deals with the distribution of sites according to selected environmental factors. Next, sites are discussed in terms of the kinds of cultural materials they exhibited when observed. The third section presents data concerning the kinds and numbers of lithic artifacts (i.e., flaked and nonflaked stone) recovered from the sites. In the fourth section, information is presented on the size, depth, type, and condition of the sites. The fifth section is an assessment of the effects of the reservoir on cultural resources and the sixth deals with their potential for loss.

Environmental Characteristics of the Sites

Knowledge about the distribution and location of known cultural resources is fundamental to both research and management objectives. With this knowledge it is possible both to forecast site locations based on existing knowledge and to predict or explain their locations based on models derived from theoretical expectations. The principal objective of this section is to describe and discuss, in general terms, the sites' positions on the landscape. In the most general terms sites in the project area are encountered most frequently in the following locations: (1) in the northern or Tobacco Plains zone, (2) on the east or left side

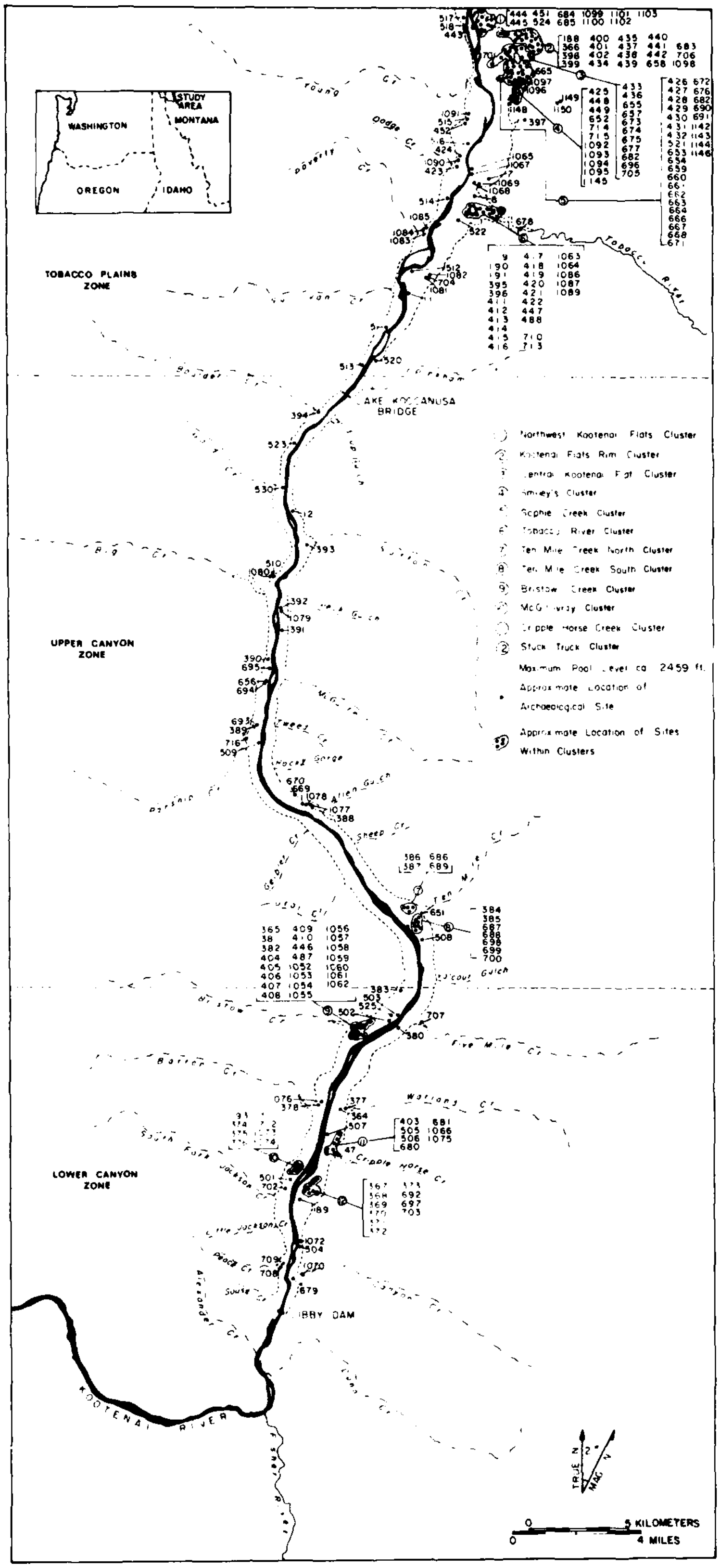


Figure 6-1. Map of the project area indicating the location of all known sites.

of the Kootenai River, (3) on middle terraces, (4) on bar/terrace type landforms in settings with good solar exposures, and (5) in places more than 300 m from permanent water. Conversely, a significantly lower frequency of sites occurs in the following settings: (1) the central or Upper Canyon zone, (2) on the west or right side of the river, (3) on the higher terraces, (4) on fan/debris flow landforms, especially in places with poor solar exposures, and (5) in locations within 100 m of a permanent water source. A considerable amount of caution is in order regarding interpretation of the preceding facts. For example, it is apparent that the large number of sites in the Tobacco Plains zone (see Figure 6-1), particularily those in the Kootenai Flats area at a considerable distance from permanent water, skew the overall results. This, coupled with the fact that few areas in proximity to the prereservoir Kootenai River channel were surveyed systematically, probably explains the fact that sites are encountered most frequently in places more than 300 m from permanent water. Table 6-1 provides a summary of the environmental characteristics or locational factors mentioned above and discussed in the following subsections.

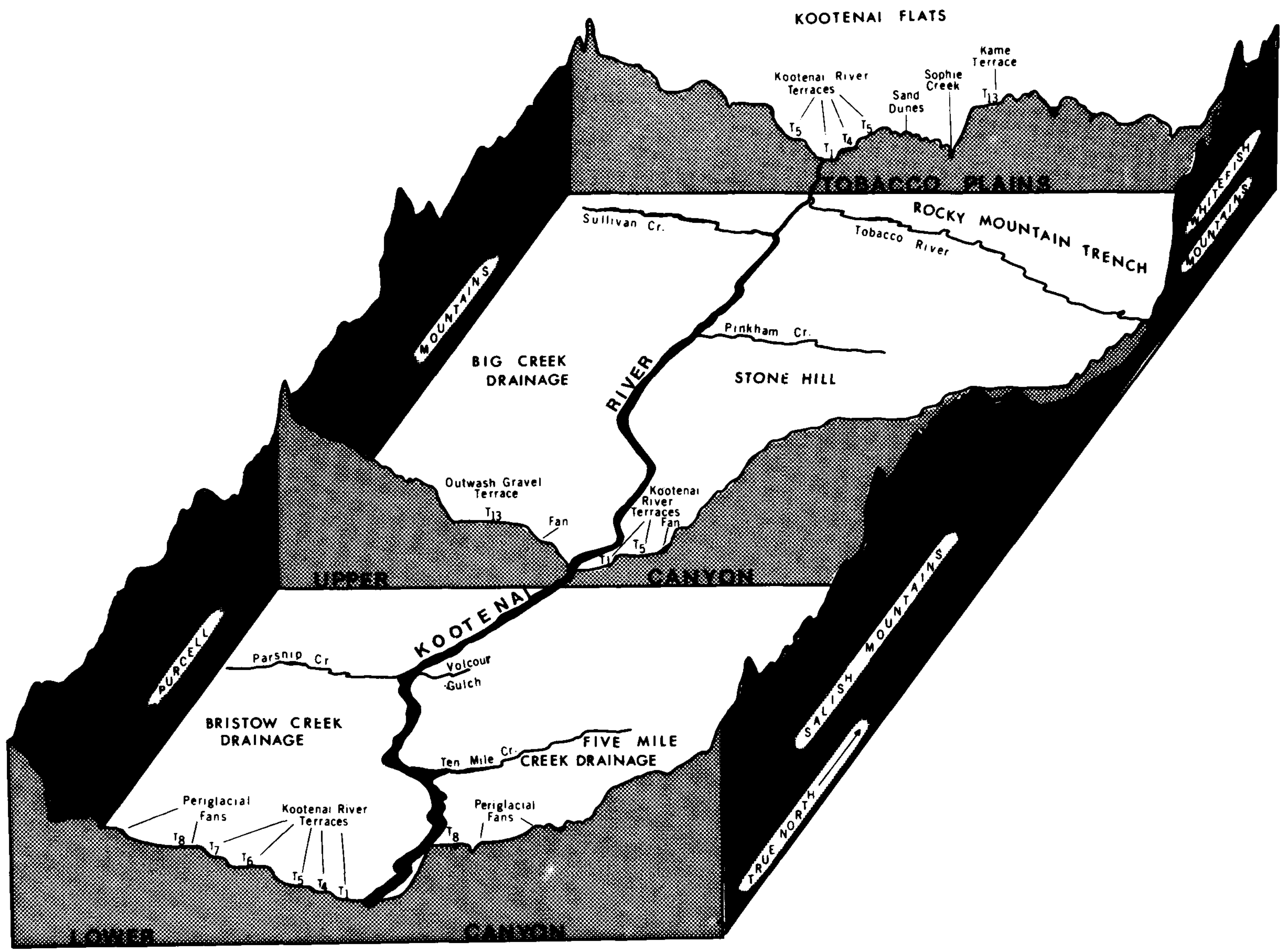
Reservoir Zones

As noted in Chapter 3, the project area is part of what Roll (1982) termed the Barrier Falls subarea, an area from which anadromous fish are excluded by the presence of substantial waterfalls located near the mouth of the Kootenai River in British Columbia. Stacked terraces, steep valley walls, alluvial fans, debris flows, and dune fields are the major landforms within the area surveyed. For sampling and analytical purposes the area surveyed was divided into three zones (i.e., Mesolocational zones, see Chapter 3 and 5), based on the interrelated and highly correlated attributes of valley morphology, vegetation, and precipitation. Figure 6-2 is a schematic cross section of the three zones. Because these divisions are partially based on physiographic and geomorphic characteristics, they are similar to those conceived by Jermann and Aaberg (1976) as part of the design for their stratified random sample survey. The zones also represent a more detailed breakdown of Roll's (1982) Canyon and Valley localities. Each of the three zones exhibits a different set of characteristics and it is expected that site distributions also differ in response to differential availability of important food resources or other environmental factors.

The overall project area encompasses approximately 7,050 hectares or 70.5 km^2 (ca. 17,400 acres or 27.2 square miles), but it should be remembered that much of the area was inundated and thus has not been surveyed systematically. Nonetheless, the three zones are roughly equal in size. The Lower Canyon zone contains about 22.3 km^2 (or 31.6% of the entire area); the Upper Canyon zone has some 22.7 km^2 (32.2%), and the Tobacco Plains zone encompasses approximately 25.5 km^2 (36.2%). Because of the similarity in the size of the three zones, the distribution of sites provides a reasonable indication of site density. The reader is referred to Chapter 3 of this report for a more detailed discussion of the regional and project area environments.

Table 6-1. Summary Data for Environmental Characteristics of the 249 Inventoried Sites.

Characteristic	Category N (%)			
Reservoir or Meso-locational zone	Lower Canyon 69 (27.7)	Upper Canyon 37 (14.9)		Tobacco Plains 143 (57.4)
Side of river	East or left side 182 (73.1)		West or right side 67 (26.9)	
Terrace setting	Lower 83 (33.3)	Middle 107 (43.0)		Higher 59 (23.7)
Type of landform	Bar 130 (52.2)	Dune 65 (26.1)	Fan 50 (20.1)	Other 4 (1.6)
Type of solar exposure	Good 113 (45.4)	Moderate 103 (41.4)		Poor 33 (13.2)
Distance to permanent water	Near 43 (17.3)	Moderate 63 (25.3)		Far 143 (57.4)



Fi-ure 6-2. Schematic cross section illustrating topographic characteristics of the three reservoir segments.

The southern segment or Lower Canyon zone, located between Libby Dam and Volcour Gulch, is characterized as a fairly wide valley with moderately sloping valley walls, and an extensive terrace system. Large tributaries enter the valley from the east and west. Precipitation is comparatively moderate (ca. 20-25 inches), overall forest cover is moderate, and there are numerous, open grassy patches, especially on the south-facing slopes and other areas with good solar exposures. It has a moderate amount of ungulate primary winter range (i.e., foraging space below 3,000 feet amsl and within 5 km of the Kootenai River). In comparison to the other two zones, food resource diversity and perhaps abundance are potentially moderate. There are 69 known sites in the Lower Canyon zone, representing 27.7 percent of the total number (i.e., 249). In terms of site density, there are approximately 3.1 sites per km^2.

In the central segment or Upper Canyon zone, situated between Volcour Gulch and Pinkham Creek, the valley is narrower and has steeper walls. Most of the tributary streams are smaller than those in the Lower Canyon zone. Annual precipitation (ca. 25-30 inches) is slightly higher than in the southern or northern zones. The terrace remnants are also less extensive. Alluvial fans and debris flows (inactive) are quite common. The amount of nearby ungulate foraging space is considerably less than the other two zones. In general, the forest is more dense and grassy patches are less extensive than to the north or south. Overall food resource diversity and abundance may be the lowest in this zone. Based on field observations, yarding of game animals during winter is very characteristic of this zone. The Upper Canyon zone exhibits 37 (14.9%) of the known sites. Site density is lowest in this zone, with about 1.6 sites per km^2.

The northern segment or Tobacco Plains zone, located between Pinkham Creek and the International Boundary, is characterized by a very wide valley. Valley walls tend to be more than a mile from the river, and the overall topography is one of comparatively low relief. Dune fields, glacio-lacustrine terraces, and wide alluvial terraces are the dominant landforms. Precipitation is relatively low (ca. 15-20 inches), and temperatures are colder than to the south. Open grasslands and relatively fewer trees are characteristic, and the amount of ungulate foraging space is far greater than for the other two zones. The potential food resource diversity and perhaps abundance is probably the greatest in this zone. The majority of known sites--143 or 57.4 percent--are located in the Tobacco Plains zone which also has the highest site density, approximately 5.6 sites per km^2.

Side of the River

Classification of sites according to the side of the river on which they are located yields an interesting statistic. The ratio of sites on the east side compared to those on the west is approximately 2.7:1. It is the east side of the river that has better overall solar exposures and consequently more browse vegetation for game animals and probably more edible plants for humans. Thus, as in the case of the three

mesolocational zones, the highest density of sites is found where the expected abundance and diversity of food resources is greatest. There are 182 (73.1%) sites on the east side of the river and only 67 (26.9%) on the west side. Of course, the overall distribution of sites is explained partially by the fact that the majority (i.e., 62.2%) of the 143 sites in the Tobacco Plains zone are located in the Kootenai Flats area on the east side of the river. Even so, most (ca. 65%) of the Upper Canyon zone sites are on the east side of the river. However, in the Lower Canyon zone, only about 41 percent of the 69 sites are on the east side. This latter distribution may reflect the fact that large tributary streams entering the Kootenai River from the west are adjacent to large, relatively flat areas with good solar exposures. In fact, 31 of the 41 sites in the Lower Canyon zone and on the west side of the river are in such settings.

Terrace Settings

It has already been noted that the project area is characterized, in part, by the occurrence of abandoned river terraces, often manifested as a vertically differentiated or a "stacked" series of remnants that are set against the valley walls. While all flat-topped land surfaces in the reservoir are not terraces in the depositional sense, almost all landforms (e.g., fans and dunes) are graded to or have active surfaces that occur on terraces formed when the Kootenai River downcut rapidly through glacial drift deposits. The complex geologic history of the area and the approach used in designating terraces are discussed Chapter 7 of this report. Here, it is necessary only to note that the terrace on or in which a site is located provides a convenient measure of its horizontal and vertical proximity to the Kootenai River channel, of the relative age of the landform on which it lies, and to a lesser degree, of site specific environmental conditions. Classification of sites according to terrace setting also provides a means to address questions relating to valley bottom versus valley wall resources and to distinguish between riverine and nonriverine or valley wall artifact assemblages.

The first four terraces--T1 through T4--have been grouped to form the lower terrace set. Lower terrace elevations range between 2,150 and 2,370 feet amsl, depending on the location along the reservoir. A total of 83 (33.3%) sites are classified as being on or in lower terraces. This grouping includes all of the land surfaces examined prior to the impoundment of Lake Koocanusa, but only part of one of the terraces (T4) was examined systematically after impoundment. Thus, some systematically patterned site locational data are available for the lower terrace set of sites, but not to the same degree as for the middle and higher terraces.

Middle terraces include T5 and T6, and range in elevation from 2,370 to 2,420 feet amsl. The largest number of known sites--107 (43%)--are situated on or in the middle terrace set.

The higher terrace set encompasses T7 and all terraces above it. Elevations vary between 2,410 and 2,820 feet amsl. However, most of the recorded sites are below an elevation of 2,470 feet amsl. There are 59 (23.7%) known sites on higher terraces.

Types of Landforms

Classification of sites according to the type of landform on or in which they lie is another device useful in characterizing sites. Earlier, it was noted that landforms are distributed differentially within the reservoir. For example, dunes are confined to the Tobacco Plains zone. There can be little doubt that landforms are related to resource availability in important ways and these differences are important factors in discussing settlement patterns. Landforms also relate to the degree and rapidity of erosion that threatens the nonrenewable cultural resources (see discussion of project effects later in this Chapter). For heuristic purposes, four general kinds of landforms containing cultural resources are recognized in the project area.

The term bar encompasses river (fluvial) bar and terrace landforms. Sediments on these tend to be sandy with only minor amounts of gravels. Bars occur throughout the reservoir, but are most characteristic of the Lower Canyon zone. Most (130 or 52.2%) of the known sites are situated on or in bars.

Fan, as used herein, is a broad category encompassing several distinct, but related deposits, including colluvial and alluvial fans, deltas and debris flows. These landforms also occur throughout the reservoir but they are most characteristic of the Upper Canyon zone. Sediments tend to be sandy with numerous gravel lenses. A total of 50 (20.1%) sites are recorded on or in fans.

Dune, the third kind of landform that contains sites, consists almost exclusively of sand size and smaller wind-blown sediments. These aeolian landforms contain 65 (26.1%) of the recorded sites.

The term other, is a catch-all to encompass bedrock outcrops and morainal (glacial) features, particularly those on the west side of the Tobacco Plains zone. Only four sites comprising 1.6 percent of the total are classified as being on other landforms.

Types of Solar Exposure

Solar exposure refers to the direction in which a site faces. This factor partially controls the types of vegetation growing on and around sites and it is a general measure of the warmness of the specific location. As discussed in Chapter 3 and 4, these are important factors in attempting to explain the distribution of sites within the context of the project's research design and related models. Although there are other important considerations, sites with southern or southwestern

exposures would be expected to be warmer than those with northern or northeastern exposures. If the project area was inhabited primarily during the winter by hunting groups for most of its occupational history, one would expect a large number of sites to face in a southerly direction. Not only would such locations be warmer, but they would tend to be in immediate proximity to areas with more available browse vegetation and hence more game animals. Areas with southern or southwestern solar exposures would also be places of reduced snow accumulation.

Three general types of solar exposures are recognized in this study, good, moderate, and poor. A total of 113 (45.4%) sites are classified as having a good solar exposure, in that they face south or southwest. Sites with a moderate solar exposure face west, northwest, east, or southeast. There are 103 (41.4%) sites with a moderate solar exposure. Only 33 or 13.2 percent of the 249 sites have poor solar exposures; they face in a northern or northeastern direction.

Distance to a Permanent Water Source

Archaeologists often measure the distance between sites and permanent water sources because this is an important factor in understanding the range of activities likely to take place at a site. Fishing, for example, is unlikely to have been an important activity in settings other than in close proximity to permanent water sources, such as streams, rivers, and lakes.

The distances between sites and permanent water sources (i.e., those so indicated on USGS maps) are grouped into three categories, near, moderate, and far. There are only 43 (17.3%) sites near or within 99 m of a permanent water source. Moderate distances are defined as ranging between 100 and 299 m. A total of 63 (25.3%) sites are within a moderate distance of a permanent water source. More than half--143 or 57.4 percent--of the sites are classified as being far from permanent water, a distance of greater than 300 m.

Table 1 in Appendix C provides a tabulation of each site according to its environmental characteristics. It is intended to be part of the description of the inventoried cultural resources.

Inventoried Resources and Their Material Content

Information in this section is designed to familiarize the reader with the kinds of cultural materials found in the study area. Data have been generated for all 249 known sites, but the kinds of available information differ considerably. Information about sites recorded prior to 1975 is from the literature (Shiner 1950; Taylor 1973), which does not always present all the information categories discussed in this report. To a lesser degree the same is true of the sites recorded in 1975 and 1976 (Jermann and Aaberg 1976). Information on sites recorded after 1975, including those discovered during the course of this

project, was gathered from sites exposed in the drawdown zone. As previously mentioned, the character of those sites was subject to change on a daily basis. Because many sites were visited on several occasions, the information presented in the following subsections reflects the range and density of artifact types observed when the cultural materials were most visible.

Five broad kinds of cultural materials--lithic tools and debitage, fire-cracked rock (FCR), bone or faunal remains, rare aboriginal artifacts, and historic, nonaboriginal artifacts--are recognized as characteristic of sites in the project area. Each is discussed briefly in the following subsections. Table 6-2 summarizes the material contents of the 249 inventoried sites. Isolated finds are discussed in the final subsection.

Lithic Density

The term lithic denotes flaked stone artifacts, including tools such as bifaces and projectile points, as well as debitage or waste flakes, and cores generated as byproducts of tool manufacture. It also includes nonflaked lithic tools formed by battering (e.g., hammer and anvil stones), pecking (e.g., pestles), and grinding (e.g., edge-ground cobbles).

Lithic density is a measure of the number of items observed within a known area. In this case, an area of 20 x 20 m or 400 m^2 is used; low density is the occurrence of one to four items; medium density designates the occurrence of 5 to 19 items; and high density denotes 20 or more items per 400 m^2. Lithic density data are unavailable for 43 of the sites, representing 17.3 percent of the 249 known sites. Lithics were not observed at an additional 60 (24.1%) sites. Low densities are recorded for 88 (35.3%) sites, medium densities occur at 35 (14.1%) sites and 23 (9.2%) of the sites have high lithic densities.

Fire-cracked Rock Feature Density

Fire-cracked rock (FCR) features are discernible concentrations of four or more pieces of FCR in a one meter square area (Figure 6-3). These features probably represent the remains of hearths, ovens, piles of stone boiling rocks, or simply places where FCR of whatever kind was discarded. A lack of FCR features does not necessarily mean that FCR was absent. In most cases it probably means that the features, if ever present, have been scattered as a result of reservoir erosion and natural (e.g., plant and animal), or other (e.g., road construction) agents. FCR features were not observed at 109 (43.8%) sites, including the 27 historic sites. Information concerning the number of FCR features is not available for 34 (13.7%) sites and in one case it is known only that FCR features were present.

A low number (i.e., 1-3) of FCR features was recorded at 71 (28.5% of the 249 recorded sites) sites and 16 (6.4%) sites manifested a medium

Table 6-2. Summary Data for Site Contents at the 249 Inventoried Sites (See text for definitions of terms).

Characteristic	Number of Sites by Category (N [%])						
Lithic density	Absent 60 (24.1)	Low 88 (35.3)	Medium 35 (14.1)	High 23 (9.2)	Unknown 43 (17.3)		
Density of FCR feature	Absent 109 (43.8)	Present 1 (0.4)	Low 71 (28.5)	Medium 16 (6.4)	High 7 (2.8)	Very high 11 (4.4)	Unknown 34 (13.7)
Scattered FCR density	Absent 35 (14.1)	Present 33 (13.2)	Low 69 (27.7)	Medium 34 (13.7)	High 53 (21.3)	Unknown 25 (10.0)	
Bone type	Absent 95 (38.2)	Identifiable 12 (4.8)	Fragments 74 (29.7)	Ided. & frag. 42 (16.9)	Unknown 26 (10.4)		
Rare artifacts	Absent 220 (88.4)	Bone/shell 2 (0.8)	Antler tine 2 (0.8)	Pipe frag. 1 (0.4)	Glass bead 3 (1.2)	Metal (abo.) 2 (0.8)	Unknown 19 (7.6)
Historic artifacts	Absent 152 (61.1)	Present 78 (31.3)	Unknown 19 (7.6)				
Early preh. diagnostic	Absent 222 (89.2)	Present 6 (2.4)	Unknown 21 (8.4)				
Early mid. Diagnostic	Absent 204 (81.9)	Present 25 (10.1)	Unknown 20 (8.0)				
Late mid. diagnostic	Absent 196 (78.7)	Present 32 (12.9)	Unknown 21 (8.4)				
Late preh. Diagnostic	Absent 199 (79.9)	Present 30 (12.1)	Unknown 20 (8.0)				
Abo. hist. diagnostic	Absent 223 (89.6)	Present 5 (2.0)	Unknown 21 (8.4)				
Abo. unkn. diagnostic	Absent 80 (32.1)	Present 156 (62.7)	Unknown 13 (5.2)				
Nonabo. hist. diagnostic	Absent 151 (60.7)	Present 80 (32.1)	Unknown 18 (7.2)				

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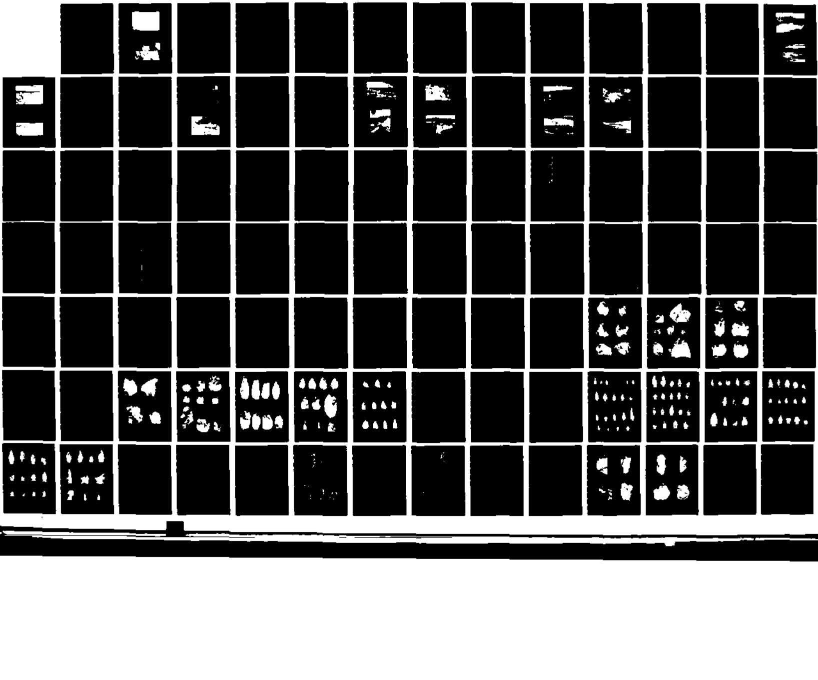

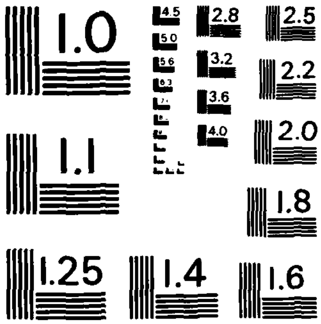

MICROCOPY RESOLUTION TEST CHART
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Figure 6-3. An example of a fire-cracked rock feature at 24LN665, a site in the Kootenai Flats portion of the Tobacco Plains zone.

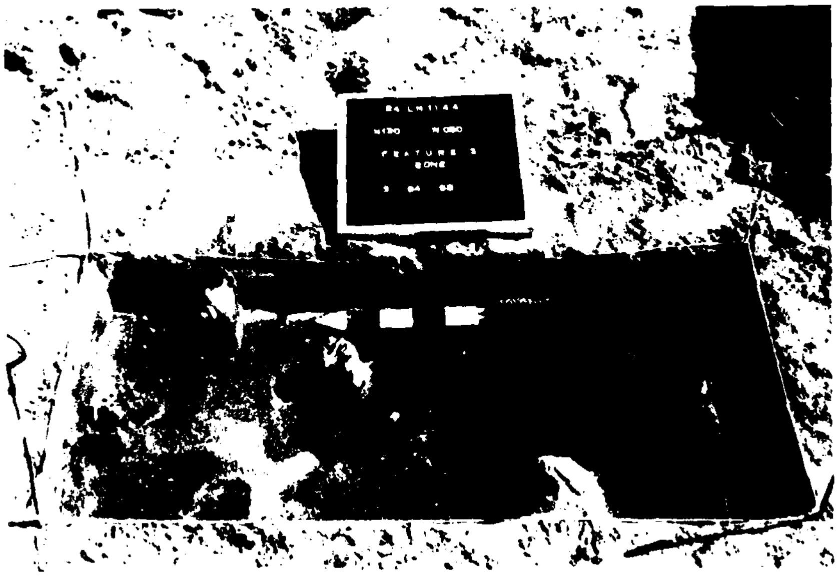


Figure 6-4. An example of burned bone fragments from an excavation unit at 24LN1144, a Kootenai Flats site.

(i.e., 4-6) number of features. Seven (2.8%) of the sites had a high number (i.e., 7-11) of FCR features and an additional 11 exhibited a very high number (i.e., 12 or more) of FCR features.

Scattered Fire-cracked Rock Density

Scattered fire-cracked rock is the most common kind of cultural material observed in the project area. It occurred at 189 sites, including several classified as historic, nonaboriginal. It was absent from 35 (14.1%) sites and data are not available for another 25 (10%) sites.

The density of scattered FCR was measured the same way as lithic density, except for 33 (13.2%) sites where only its presence was recorded. Of the 156 sites with density estimates 69 (44.2%) are recorded as being low, 34 (21.8%) as medium, and 53 (34%) as being high.

Bone Type

Except for historic sites, faunal materials were not very abundant and most observed bone was in the form of small, burned fragments often associated with FCR features. The great majority of identified faunal materials represent the remains of deer, but mountain sheep and elk are represented. Historic, nonaboriginal sites often contained deer bones but the bones of cattle were most frequent. A total of 42 sites contained both identifiable and fragmentary faunal remains. Twelve sites, primarily historic ones, yielded identifiable bones but no burned fragments and an additional 74 sites, almost all of which were aboriginal, exhibited burned bone fragments (Figure 6-4). Bone was not observed at 95 sites and data are not available for 26 of the sites.

Rare Artifacts

Included as rare artifacts are those items preserved infrequently or that are exotic (i.e., that are made from materials not native to northwestern Montana); 10 sites yielded rare artifacts. Deer antler tines with use-wear were recovered from 24LN193 and 24LN364, a shell bead was found at 24LN1086, and three pieces of exotic shell were collected from 24LN366. Small fragments of sheet copper ornaments were recovered from 24LN513 (Taylor 1973) and 24LN1054. Glass trade beads were collected from sites 24LN427, 24LN443, and Taylor (1973) recovered beads from 24LN521. A fragment of an elbow pipe made from pipestone was found at 24LN517 (Taylor 1973).

Historic Artifacts

Historic artifacts are those items judged to derive from Euroamerican occupations in or near the project area. However, Native

Americans, especially the Kutenai Indians, lived in the area at least until 1880 and undoubtedly also used historic artifacts. Almost all the historic artifacts observed and/or collected are readily attributable to late nineteenth or twentieth century occupations. Examples include metal containers, machinery parts and fragments, glass and ceramic containers and fragments, as well as the remains of structures. Historic artifacts were present at 78 (31.3%) of the sites and there is insufficient information to determine the presence or absence of historic artifacts at 19 (7.6%) of the recorded sites.

Cultural/Chronological Diagnostics

The designation of sites according to their cultural and chronological affiliations is an important aspect of cultural resource investigations concerned with changes in land use patterns. In most cases, distinguishing between aboriginal (i.e., historic and prehistoric Native American) and nonaboriginal (i.e., primarily Euroamerican) cultural affiliations is straightforward because aboriginal groups relied primarily on stone to manufacture nonperishable tools, while nonaboriginal groups utilized metal, glass, and ceramic items.

The presence of metal, glass, and ceramic items also indicates occupation within the last 200 or so years. Sites older than 200 years are usually dated using stratigraphic and radiocarbon techniques, but in the project area these techniques are seldom applicable because of slow rates of deposition, bioturbation and poor preservation of organic materials. Only one site--24LN677--yielded enough bone for a radiocarbon date (3,260±100 B.P.) and with few exceptions stratigraphic separation of cultural deposits was almost impossible. As a result, chronological designations for most aboriginal sites are based on the presence of projectile points with stylistic attributes considered to be diagnostic of broad time periods. This dating technique is possible because similar projectile points occur in dated contexts at sites in the surrounding areas including lower terrace sites just below Libby Dam (Roll and Smith 1982). Nonetheless, the assignment of project area sites to generalized time periods must be considered tentative at best.

As noted, several of the 27 historic sites and most of the historic materials observed at 53 aboriginal sites, represent little more than trash dumps. The remains of 17 farm/ranch sites are included in the historic sites as are two trestle structures and an extensive early-middle twentieth century logging camp (24LN370). With the possible exception of 24LN521 and 24LN701, and perhaps some of the sites recorded prior to 1970, the known historic sites are considered to be post-1880 in age. However, historical research (Chance 1981, 1982) indicates that the remains of early nineteenth century historic sites related to fur trading activities of the Northwest and Hudson's Bay companies are probably present within the confines of the reservoir, but in areas inundated during the 1981-1982 surveys. All of the sites with historic material not considered to have been used by Native Americans, are classified as having a historic nonaboriginal component.

Based on the presence of glass beads and copper fragments, five of the aboriginal sites have historic components indicating occupation or utilization of the localities after about AD 1750. These sites are designated as having a historic aboriginal component. Several other sites in the northern part of the reservoir may well have historic aboriginal components, as indicated by the presence of bone beads, shell pendants or the reported (i.e., local relic hunter informants) occurrence of glass trade beads.

Most of the aboriginal sites probably are prehistoric in age, but 156 of them lack chronologically diagnostic artifacts and are placed in the aboriginal unknown category. Numerous sites yielded projectile points that indicate a period of occupation (probably intermittent) that spans thousands of years. Identified projectile points and unidentified fragments have been recovered from about half of the known sites. There are 30 sites with arrow-size projectile points suggesting occupation during the Late Prehistoric Period (ca. 1500-1000 to 200 B.P.). The late Middle Prehistoric Period (ca. 4,500 to 1,500-1,000 B.P.) is represented by 32 sites with large (dart size) corner-notched and wide side-notched projectile points. Large stemmed points and those with relatively narrow and deep side-notches are considered to be indicative of the early Middle Prehistoric Period (ca. 4,500 to 8,000 B.P.) and are represented at 25 sites. Only six sites yielded large, lanceolate shaped projectile points thought to represent the Early Prehistoric Period (ca. older than 8,000 B.P.).

Table 2 in Appendix C is a site by site tabulation of site contents according to the characteristics discussed in the preceding subsections. It provides a description of the known contents of each site, at least insofar as available data permit.

Isolated Artifacts

A total of 46 isolated artifacts or localities is recorded in the project area. It should be remembered that the distinction between sites (i.e., places with five or more artifacts) and isolated artifacts (i.e., places with four or fewer artifacts) is an arbitrary one. It also would have been possible to refer to the locations of all cultural materials, regardless of the number of items, as sites. In that case, there would be 295 sites and no isolated artifact finds. Nonetheless, for purposes of simplicity and perhaps because of tradition, the distinction between sites and isolated artifacts is maintained. Most of the isolated artifacts are single items occurring in isolation from other cultural materials. Several are "localities" consisting of two to four items found in close proximity. It is quite possible that numerous isolated artifact locations are actually sites as defined in this report, but were not recorded as such because fewer than five artifacts were observed; also, additional artifacts may have been obscured by postreservoir sediments or may not yet have been exposed by erosional processes. In other cases (e.g., isolated projectile points or glass bottles) it is possible that the item was accidently or intentionally discarded and indeed represents an isolated artifact. The kinds of

cultural materials recorded as isolated artifacts are, in all cases, also found at sites. Fifteen of the isolated artifacts were found within 100 m of known sites and only six were found more than one km from the nearest known site. Table 3 in Appendix C provides descriptions and locations for the 46 isolated artifact finds.

Lithic Artifacts

Lithic artifacts represent the majority of cultural materials recovered from the 139 sites having collections available for this study. In addition to lithic artifacts, FCR was collected from 10 of these sites, faunal remains from 74 sites, and historic artifacts from 32 sites.

The collection includes 32,201 flaked and nonflaked lithic artifacts from 117 aboriginal sites, but about 78 percent of the items are from five sites (24LN429, 24LN704, 24LN1054, 24LN1058, and 24LN1073). For analytical purposes, the recovered artifacts were grouped into 10 morphological/functional types. Morphological/functional indicates that the classification scheme is based on a combination of morphological (i.e., denoting the overall size and shape of the artifact) and functional (i.e., how the artifacts are considered to have been used) factors.

The 181 cores represent 0.56 percent of the collection and are defined as blocks or cobbles of raw material from which flakes were detached, but which show no evidence of use as a tool. In other words, cores are a byproduct of the manufacture of flaked lithic tools. Flakes and shatter are also byproducts or pieces of debitage (i.e., waste material). They constitute 95.41 percent (30,723 items) of the total collection. Together, byproducts account for about 96 percent of the collection.

All other items in the collection are classed as products, and are considered to be tools and/or manufactured blanks for the production of tools. The 1,297 flaked lithic products constitute approximately 4 percent of the collection. Thick bifaces are relatively heavy, bifacially flaked items that appear to have been used as tools for heavy-duty chopping and cutting tasks or as blanks for the production of thin bifaces. A total of 75 thick bifaces, representing 5.8 percent of the lithic products was recovered from the project area. Thin bifaces represent 17 percent (221) of the flaked lithic products and are considered to have been used for light-duty cutting, scraping, and drilling tasks as well as blanks for the production of projectile points. A total of 51 (3.9% of the lithic products) arrow-size projectile points was recovered and dart-size projectile points account for an additional 154 items (11.9%) in the products category. Thin edge modified flakes represent the bulk (i.e., 491 items or 37.9%) of the products and are considered to have been used for light-duty cutting and scraping activities. Thick edge modified tools, probably used for relatively heavy-duty tasks, represent 151 (11.6%) of the products.

Nonflaked lithics--battered, ground, pecked, grooved, and incised stone--are also considered to be tools and they constitute 144 items or 11.1 percent of the products. These items functioned as hammerstones, anvil stones, pestles, mauls, and grinding stones. Net weights are thin discoidal cobbles with notches on opposite edges; they may have been used as weights on fishing nets. The collection includes 10 net weights.

Table 4 in Appendix C is an inventory of lithic artifacts in the collection of materials available for this study. It provides a list of the artifacts recovered from each site and indicates which sites were not collected.

Broad Characteristics of Cultural Resources in the Libby Reservoir Area

Consideration of the broader aspects of cultural resources in the project area provides a convenient way to conclude the descriptive sections of this chapter and to introduce the subsequent section that concerns assessment of the reservoir impacts on cultural resources. Site condition, size, depth, and type are viewed as the broader characteristics of sites. Brief discussion of these characteristics provides the reader with a synthesis of what has been presented before, it places physical bounds around the sites, and it characterizes their states of preservation (Table 6-3).

Site Condition

Classification of sites according to their condition (i.e., state of preservation) is a qualitative assessment based on field observations. The information necessary to make this assessment was drawn from site forms and field notes, but the decision to place a site in a particular category was made after fieldwork by the Project Director. In most cases he had seen the site but when he had not, the decision was based on recorded information and knowledge of the site's microlocational setting.

The principal criteria employed in assessing sites were the degree of horizontal integrity as measured by the intactness of features, and the amount of erosion that had taken place as a result of reservoir operation. The degree to which tree roots were exposed facilitated assessment of the amount of erosion. It is difficult to overemphasize the rapidity at which sites are damaged in the project area by a variety of agents and it should be noted that sites herein considered to be in good condition might well be viewed as being in poor condition if the sites were in settings other than a drawdown zone. In other words, the assessment of site condition is a relative one. However, it does provide a qualitative measure of what remains of the site. Site condition categories are defined in the following paragraphs.

Table 6-3. Summary Data for the General Nature of the 249 Inventoried Sites.

Characteristic	Category N (%)				
Site condition	Good 28 (11.3%)	Fair 81 (32.5%)	Poor 84 (33.7%)	Destroyed 17 (6.8%)	Unknown 39 (15.7%)
Site size	Small (1-1000 m^2) 91 (36.6%)	Medium (1001-6000 m^2) 84 (33.7%)	Large (>6000 m^2) 54 (21.7%)		Unknown 20 (8.0%)
Site depth	Less than 30 cm 42 (16.9%)		Greater than 30 cm 23 (9.2%)		Unknown 184 (73.9%)
Site type	High diversity 34 (13.7%)	Low diversity 129 (51.8%)	Debitage only 4 (1.6%)	FCR and bone 16 (6.4%)	FCR only 12 (4.8%)
	Rock art 2 (0.8%)	Rock alignment 3 (1.2%)	Historic structure 20 (8.0%)	Historic debris 7 (2.8%)	Missing data 22 (8.9%)

Good, N=28 (11.3% of the 249 sites)

Less than half of the site area has been eroded, and most features retain their horizontal integrity. Almost 90 percent of the sites in this category are on bar or fan landforms. These are settings less likely to be eroded than are dunes.

Fair, N=81 (32.5%)

An estimated 10-40 percent of the site surface or subsurface remains relatively intact. Erosion tends to be severe along the edges of landforms on which the site is situated. Almost half (46.9%) of the sites in this category are on bars, 21 percent are on fans, and 32.1 percent are situated on dunes.

Poor, N=84 (33.7%)

Less than 10 percent of the surface and culture bearing subsurface remain intact. Few features are intact and severe erosion is occurring over most of the sites' surface. One-half of all sites on or in dune landforms are in this category, as are 30 percent of the sites on bars, and 26 percent of the sites on fans and three of the four sites on other landforms (i.e., glacial outwash).

Destroyed, N=17 (6.8%)

Almost no intact, culture bearing sediments remain and artifacts have been displaced vertically by several decimeters (i.e., more than one foot). In fact, sites in this category, especially those recorded in the 1970s, are difficult to relocate. When revisited in 1982, they were represented only by a few pieces of FCR and an occasional flaked lithic artifact.

Unknown, N=39 (15.7%)

Sites in this category, mainly those recorded in 1950, the 1960s, and in 1975, have remained inundated and their condition is unknown. However, because they have remained inundated, they have been subjected to comparatively minimal wave action during drawdowns and consequently they may remain in fairly good condition.

Site Size

Site size refers to the horizontal area over which cultural materials are distributed. Sites within the drawdown zone ranged in size from 1 m^2 (24LN1077) to 44,000 m^2 (24LN417). For analytical purposes, sites were grouped into several size categories.

Small N=91 (36.6% of the 249 sites)

Sites range in size from 1 m^2 to 1,000 m^2 or an area about 30 by 33 m in size.

Medium, N=84 (33.7%)

Sites range in size from 1,001 m^2 to 6,000 m^2 or an area about 75 by 80 m in size.

Large, N=54 (21.7%)

All sites are larger than 6,000 m^2 and smaller than 44,000 m^2 or an area about 440 by 100 m in size.

Unknown, N=20 (8.0%)

These are primarily sites recorded prior to 1976 for which size information is not available or could not be checked because the site was inundated during the 1981-1982 survey.

Site Depth

Site depth refers to the vertical extent of cultural deposits. Because of the slow rate of deposition throughout the project area during the time periods of known human occupation, most cultural materials occur very near the surface. They are buried beneath an organic layer and most are confined to the upper few centimeters of inorganic sediments. In these settings some artifacts have been displaced by bioturbation (e.g., rodent activities and tree throws or tip-ups) or cryoturbation (e.g., freezing and thawing of the sediments). There are, of course, numerous sites where relatively intact cultural materials are buried at greater depths, either as a result of postreservoir deposition (e.g., 24LN443) or because they were in a setting where deposition was comparatively rapid during prehistoric times (e.g., 24LN704, 24LN1054, and 24LN1058).

It was not feasible to test every known site, but the majority of those that appeared to have a potential for depth were tested at least at the exploratory level. Testing by probing was designed to determine whether or not cultural materials were present immediately under postreservoir sediments, not to determine the overall depth of deposits. Depth assessment for sites exposed in cutbanks along the reservoir margin was based directly on an examination of the cutbank. In general, depth of deposits is not a reliable means of assessing the potential significance of sites because parts of many surface and near-surface sites exhibit extraordinarily intact features. It should be kept in mind that all sites were "surface sites" at some point or points in their history. Furthermore, assemblage and feature contexts under some

circumstances, may be intact in currently exposed sites; other sites may lack integrity even though they are currently buried. For purposes of this report, sites were categorized according to whether intact cultural materials were buried at depths greater than or less than 30 cm beneath the present surface.

Less than 30 cm, N=42 (16.9% of the 249 sites)

All intact cultural deposits were found above 30 cm below surface but some out-of-place artifacts may have been recovered from below that depth. Site volume estimates can be obtained by multiplying the area by the average depth of 30 cm.

Greater than 30 cm, N=23 (9.2%)

Sites in this category were tested using exploratory or full-scale techniques. Relatively intact cultural deposits were encountered at depths between 30 and 130 cm beneath the surface. Only three sites--24LN443, 24LN1054, and 24LN1058--yielded substantial quantities of material below 75 cm beneath the surface. Reasonably accurate site volume estimates can be made by multiplying the site area by an average depth of 50 cm.

Unknown, N=184 (73.9%)

This category includes the 13 sites tested using the probing method exclusively as well as the 171 other sites not subjected to subsurface testing. It is probable that the majority of sites in this category exhibit cultural remains at or near the surface. However, relatively deeply buried sites occur throughout the reservoir and on almost all landforms. Although only one dune site (24LN1144) contained deeply buried materials, other such sites may await discovery, particularly the dune field portion (i.e., Kootenai Flats) of the Tobacco Plains zone. Deeply buried materials were also found in one fan site--24LN707--although most of the cultural material had been disturbed by natural processes. The bar/terrace landform near the mouth of Bristow Creek yielded the most intact, buried cultural deposits, particularly from sites 24LN1054 and 24LN1058.

Site Types

The site type classification scheme is based on the kinds of artifacts and/or features observed at the sites and is intended to be a relative measure of the range of activities that are likely to be represented. Because this project emphasized aboriginal cultural resources, sites that exhibited both aboriginal materials and nonaboriginal historic materials are classified as aboriginal. Sites with only historic materials are classified either as debris scatters or structural remains. Most aboriginal sites are subdivided according to

the number of classes of artifacts observed. This classification scheme was designed originally for determining which sites would be tested and a modified version is used for designating site types. The artifact classes established are as follows: (1) flakes and shatter, (2) cores, (3) edge modified flakes and cobbles, (4) unifaces or formed scrapers, (5) bifaces, (6) dart-size projectile points, (7) arrow-size projectile points, (8) miscellaneous hafted bifaces, probably used as knives, (9) battered stone, (10) pecked stone, (11) ground stone, (12) grooved and/or incised stone, (13) fire-cracked rock, and (14) bone fragments, most of which are in the form of small, burned bits. The various site types are described in the following paragraphs.

<u>High Diversity Sites, N=34 (13.7% of the 249 sites)</u>

Sites exhibit seven or more of the classes of artifacts, indicating that a fairly wide range of activities are represented (Figures 6-5 and 6-6). Most (52.9%) of the high diversity sites are in the Lower Canyon zone; a little less than half (44.1%) are situated more than 300 m from a permanent water source, and more (41.2%) of them are on middle terraces than on lower (29.4%) or higher (29.4%) terraces.

<u>Low Diversity Sites, N=129 (51.8%)</u>

Sites are characterized by the presence of six or fewer classes of artifacts, but they always contain at least one kind of lithic artifact (i.e., flaked or nonflaked stone). Low diversity sites are the most common kind of site in the reservoir area (Figures 6-7 and 6-8). They probably are locations where either the range of activities carried out was rather narrow or the length of occupation was not sufficient to result in the deposition of artifacts representing the range of activies conducted there. Low diversity sites occur throughout the area, but are most common on middle terraces (49.6%), far from water (65.9%), and in the Tobacco Plains zone (58.1%).

<u>Debitage Only Sites, N=4 (1.6%)</u>

This uncommon kind of site is represented only by the presence of lithic waste flakes. Assuming that field observations reflect what actually is present, these sites probably functioned primarily as chipping stations or places on the landscape where stone tools were either manufactured or reconditioned. Three of the four sites are on middle terraces and/or in the Tobacco Plains zone. All of them--24LN436, 24LN442, 24LN702, and 24LN1083--are more than 300 m from permanent water.

<u>Fire-cracked Rock and Bone Sites, N=16 (6.4%)</u>

These sites fail to exhibit any kind of lithic artifact. They are represented only by burned bone fragments and FCR features or scattered

Figure 6-5. Site 24LN365, a medium size, high diversity site located near the mouth of Bristow Creek, in the Lower Canyon zone.

Figure 6-6. Site 24LN387, a medium size, high diversity site located near the mouth of Ten Mile Creek, in the Upper Canyon zone. Wire flags denote artifact locations.

organic materials probably are being lost. Information relating to group size and behavior patterns, as derived from analysis of the spatial relationship among artifacts and features, also is being lost as sites erode. These kinds of information are essential to an understanding of past human behavior in the project area, and by extension, in the forested areas of the Northern Rocky Mountains.

Geologic information also is being lost rapidly. This information is necessary to understand past environmental conditions that affected the area's animal and plant life, as well as human populations. Examples of geologic information or data categories include stratigraphic profiles of inorganic sediments that document changing hydrologic regimes, buried and burned surfaces that contain plant materials useful in dating deposits and determining past vegetation, bog deposits that contain similar materials as well as pollen, and deposits of volcanic ash most useful in dating natural and cultural deposits.

The preceding discussion has focused on the potential for loss of information concerning cultural resources in general. While it has been argued that the potential for loss is great, the question of the significance of the information subject to loss has not been addressed. That question is addressed explicitly in Chapter 13. However, at this juncture a few general comments are appropriate.

The potential for loss of significant information probably is greater in a comparative sense than it would be for many other riverine settings in the Northwest. Several factors account for this. Most important is the fact that the Lake Koocanusa portion of the Kootenai River Valley has a higher density of sites in more diverse locations than has been demonstrated for any other similar area in the Northern Rocky Mountains or the Pacific Northwest. Although it is probable that other river valleys actually have similar distributions of cultural resources, the Lake Koocanusa area remains as the best documented case. Stated differently, the known and suspected data base from Lake Koocanusa is the most comprehensive one available to address questions of long-term changes in land use systems in a montane coniferous forest. Considering this and the rapid rate at which the sites' integrity is being lost due to reservoir related erosion, as well as the fact that none of the known sites has undergone extensive intrasite analysis, it seems demonstrable that potentially significant information is being lost faster than it can be retrieved and interpreted. Much of the information already gathered remains to be analyzed fully, but enough has been accomplished to demonstrate that there is a potential for analyses of site structure, lithic technology, and tool function, etc. to increase the understanding of past human behavior. In addition, unrecorded sites and features as well as potentially important geologic locations are exposed annually. These unrecorded cultural resources are likely to yield badly needed and rare organic material for radiocarbon dating. Equally important faunal materials may also be found, and if so, analysis of these materials would yield information important in understanding subsistence patterns.

13). This means of assessing loss requires that specific data categories (such as flaked stone, comparatively rare faunal materials, or other organic remains) are known or strongly suspected to occur within the site and that once recovered from the site, they can provide specified information (e.g., stages of manufacturing sequences, subsistence information, and radiocarbon dates) that is likely to shed new light on questions of ethnic, historic, or scientific significance.

From a reading of the information thus far presented in this chapter, it should be clear that a great deal of potentially useful information concerning past human behavior already has been gathered, but that much remains to be gathered from the Libby Dam-Lake Koocanusa area. It has been argued that many of the cultural resources which can yield this useful and important information are being lost at a rapid rate.

With the possible exception of those cultural resources that lie beneath the minimal pool elevation, there is a potential for loss of part or all of almost every known site in and adjacent to the reservoir. This is demonstrated by the fact that the 17 sites, which can be documented as having been destroyed recently, occur on every landform type; 35.3 percent are on bars, 23.5 percent on dunes, another 23.5 percent are on fans, and 17.7 percent are on other landforms. The fact that only 28 or 11.2 percent of the 249 sites are in good condition is another indication of the number of sites that are being destroyed. Although it has been noted that there were some adverse natural and cultural effects on sites prior to the construction of Libby Dam and the operation of Lake Koocanusa, it is clear that reservoir-related adverse effects represent the most serious threats to the integrity and even the existence of these resources. It is evident that an assessment of the condition of these same sites prior to reservoir impoundment and operation would have resulted in far more being placed in the "good condition" category. However, it also should be recognized that many of the sites probably would not have been found if the Libby Dam-Lake Koocanusa project had not been undertaken.

In terms of the rapidity of loss of useful and important information, sites situated on sandy landforms are being destroyed at a more rapid rate than are those on gravelly landforms. This is evident when the sites in poor condition are compared to the landform types on which they are situated. Of the 84 sites in poor condition, 38 (45.2%) are on sandy bars, 33 (39.3%) are on sand dunes, and 13 (15.5%) are on gravelly fans. Fully 50% of the 65 dune sites are in poor condition as are 29 percent of the bar sites and 26 percent of the fan sites.

To summarize, the potential for loss of historic and prehistoric cultural resources in the project area is great. For the known sites, locational information and some cultural materials have already been recovered. However, for the yet-to-be-discovered sites there is no locational information. For those, as well as numerous known sites, the potential also is great for loss of information (i.e., artifacts) that can be gained from studies of lithic technology and lithic artifact function. Subsistence data in the form of comparatively uncommon faunal materials and chronological data derived from the rarely preserved

recover artifacts. Most of these pits are about 30 cm in diameter and 20 cm deep, but at site 24LN701 they are much larger and attain depths of approximately 1 m.

Although the damage done by relic collectors is concentrated in the Tobacco Plains zone, it occurs throughout the area. In fact, the illegal collection of stone tools, glass beads, bottles, and coins appears to be a popular form of recreation during the late spring and early summer when the drawdown zone is exposed and readily accessible. Based on conversations with several relic collectors, it is apparent that these individuals consider this form of recreation to be an inalienable right. Simply stated, the activities of relic collectors in the Lake Koocanusa area are devastating nonrenewable cultural resources faster than they can be documented professionally. The result is that the public at large is being denied an information base from which knowledge about past human cultures can be generated.

It has already been noted that the land surfaces between an elevation of 2,342 and 2,287 feet, (i.e., the minimal pool elevation as illustrated in Corps of Engineers and Forest Service documents), have not been intensively surveyed for cultural resources. Precise assessment of the reservoirs impact on the sites recorded in these areas is impossible because the sites have not been examined (i.e., they have been under water) since they were first recorded in the mid 1970s. Because these sites, as well as still buried and unrecorded ones, have not been subjected to drawdown related erosion and deposition, they should be less adversely affected than sites at higher elevations. However, it is important to note that the knowledge of the reservoir's cultural resources remains incomplete until the lower elevations are surveyed and the cultural resources are inventoried and tested. It is expected that these lower elevations might contain site types (e.g., plant food procurement) and conditions favorable to preservation (e.g., site burial under more recent fans) not present in the higher elevation areas already surveyed and tested.

Potential for Loss

The potential for loss of cultural resources may be assessed according to multiple criteria, the relative importance of which will vary with different approaches to cultural resources management. One convenient measure of potential for loss of resource value might consist of estimates of total artifacts that would be lost or of the total volume of sediments that would be affected if the sites were destroyed. Although such measures are often difficult to make or estimate, they are appealing because they are quantitative, easy to understand, and facilitate comparison among sites. However, they are of limited use for making management decisions, because they assume that all cultural resources are of equal importance, i.e., that the largest sites or the ones with the most artifacts, are necessarily the most significant. A more meaningful but difficult to achieve measure of potential loss is to consider what significant information sites could yield (see Chapter

Figure 6-17. Photograph of intentional vandalism at Site 24LN427. Vehicle tracks bisect excavation of a fire-cracked rock feature.

Figure 6-18. Depiction of typical vehicular disturbance in the Kootenai Flats locality, Sophie Creek site complex.

Figure 6-15. An illustration of the low dunes in the Kootenai Flats area of the Tobacco Plains zone. The tree roots have been exposed as a result of wind and water caused erosion.

Figure 6-16. Aeolian reworking of sands exposed during the drawdown in the Bristow Creek area.

on bar/terrace landforms (e.g., 24LN364, 24LN365, 24LN1054, 24LN1058, 24LN1066, and 24LN1073).

In general, parts of most sites have been affected by erosional processes related to reservoir operation, but other parts of these same sites often have been affected by depositional processes as well. Water is the most active transportation agent, but during the drawdown period wind also acts to transport sediments. Site 24LN443 provides an example of a locality where water-laid sediments have buried much of the site. Dune fields in the Kootenai Flats area (Figure 6-15) and extensive bar/terrace landforms (Figure 6-16) are most subject to aeolian processes. It is also important to emphasize that the visible character of sites may change from day to day as a result of these aeolian processes. One day, cultural materials visible on the surface of a site might include several fire-cracked rock features, flaked lithic tools, and a dense scatter of flakes. The following day, after a wind storm, the same site might appear to contain only one or two FCR features, and a few large, flaked lithic items.

Recreational Adverse Effects

The activities of relic collectors, vandals, and off-road vehicle enthusiasts also have had detrimental effects on the reservoir's cultural resources. Relic collectors virtually destroyed the surface of 24LN1054 during the 1981 field season, when they skim-shoveled and screened a major portion of the site's sediments. Similar activities were carried out at 24LN394 in 1981 and 1982. At many other sites (e.g., 24LN417, 24LN669, 24LN716, and at sites in the Bristow complex), local collectors have dug through and scattered fire-cracked rock features in search of collectable artifacts. In 1982, intentional vandalism occurred at several Sophie Creek sites (e.g, 24LN427, 24LN691, and 24LN1144) under investigation by the archaeological project. Although all excavation units were clearly marked with stakes and flagging tape, they were repeatedly driven over with a vehicle (Figure 6-17) and the stakes and wire flags marking cultural materials were pulled up and discarded. In other Kootenai Flats cases, site datum stakes were removed by vandals.

The Kootenai Flats area in the northern part of the reservoir has the highest site density and it is the area most accessible to off-road vehicles and relic collectors. In this sand dune area the sediments are not well-compacted and most sites are confined to the upper few centimeters of sediments. Off-road vehicles travel freely throughout the area and in the process have damaged many if not most of the sites by scattering features and other cultural materials (Figure 6-18). Fortunately, large standing tree stumps protect parts of most sites from this kind of destruction.

Several historic, nonaboriginal sites (e.g., 24LN521, 24LN701, and 24LN1142) in the Kootenai Flats areas have been pillaged by bottle and coin collectors using metal detectors. Their activities are not limited to collecting items from the surface; in addition, they dig pits to

Figure 6-13. An example of wave caused erosion at 24LN364, a site situated on a gently sloping fan near the mouth of Warland Creek.

Figure 6-14. Another example of wave caused erosion at 24LN365, a site situated on steeply sloping bar/terrace landform near Bristow Creek.

Figure 6-11. An illustration of the difference at site 24LN388 between areas cleared in conjunction with reservoir clearing (foreground) and those areas logged earlier (background).

Figure 6-12. An example of widespread mass slumping along the reservoir margin; photograph taken in the vicinity of Canyon Creek.

Reservoir Operation Adverse Effects

Forest clearing (Figure 6-11) and the excavation of borrow pits and pits for slash piles severely disturbed many sites in the reservoir area. These activities are especially destructive because they may severely disturb the ground surface and the deposits immediately beneath it. In the project area, most sites, particularly those on higher terraces, lie at or quite near the surface, and hence are very vulnerable to these disturbances. Fortunately, few sites were totally destroyed by these activities, and portions of most larger sites are intact. Examples of sites that are partially destroyed, yet retain intact portions, include the following: (1) 24LN1054 and 24LN1058 in the Bristow Creek area; (2) 24LN656, located north of Parsnip Creek; (3) 24LN388, located north of Allen Gulch; (4) 24LN417 on the south side of Tobacco River; and (5) 24LN366 and 24LN706 in the Kootenai Flats area.

Historic (nonaboriginal) sites were affected more adversely by forest clearing activities than were aboriginal sites, because all standing structures and structural remains within the reservoir were razed. Examples include 24LN521 (Sophie's Cabin), 24LN687, 24LN701, and 24LN705. Although the above-ground architectural features at these sites have been lost, the potential to recover important information remains. Some sites (e.g., 24LN521 and 24LN701) had cellars or other subterranean structures that are likely to be relatively intact and could yield detailed information regarding periods of occupation and the activities of the sites' occupants.

The adverse impacts noted in the preceding paragraphs have already occurred, but the effects of reservoir waters on both identified and yet-to-be-discovered sites are ongoing. Erosion of culture-bearing sediments by reservoir waters has already damaged many of the area's cultural resources and the potential for more extensive losses and destruction of sites is great. Many sites recorded in 1975 (Munsell 1981:personal communication) could not be relocated in 1981, either because they had since been destroyed or they were inundated. Examples include 24LN1063, 24LN1065, 24LN1067, 24LN1069, 24LN1070, 24LN1143, 24LN1149, and 24LN1150. Several sites recorded in 1976 (Jermann and Aaberg 1976) have been totally destroyed by the actions of reservoir waters. For example, erosion of the glacial outwash landforms on which sites 24LN1083, 24LN1084, and 24LN1085 are located has removed all culture-bearing sediments and the cultural materials have been redeposited and buried at the base of the landforms. Erosion (mass slumping) along the reservoir margins (Figure 6-12) is responsible for the loss of portions of several aboriginal sites and for the destruction of the one standing historic structure at 24LN1082. That structure, a log cabin, apparently fell into the reservoir along with the sediments that supported it.

Major portions of other sites have been destroyed or severely damaged by the actions of reservoir waters since 1975 and even since 1981. The action of waves on sites with sandy sediments is particularly devastating (Figures 6-13 and 6-14). Examples are most common in the Kootenai Flats area (e.g., 24LN400, 24LN429, and 24LN432) and for sites

each site. As defined in the preceding section of this chapter, the site condition variable primarily records the degree to which each site has been affected by erosion. The main processes that have affected or continue to affect sites in the project area are discussed below, and examples of the action of these processes at selected sites are discussed in more detail.

The construction of Libby Dam and the operation of Lake Koocanusa have had and will continue to have adverse effects on potentially significant cultural resources. Nonetheless, it is important to recognize that reservoir preparation, flooding, and operation also have provided an unparalleled opportunity to examine the actual distribution and characteristics of sites in a forested and mountainous environment. Reservoir waters have stripped away a thin veneer of surficial sediments, including the organic mat of forest duff, from much of the landscape. Archaeological sites and natural stratigraphic exposures that normally remain obscured have thus become readily visible on the denuded landscape. Results of the 1981 and 1982 intensive surveys clearly demonstrate that denudation or erosional processes are ongoing and that new sites and stratigraphic information continue to be exposed. Areas intensively surveyed in 1976 (Jermann and Aaberg 1976) were resurveyed in 1981 and many new sites were recorded. This happened again during the 1982 survey when areas covered in 1981 were reexamined. For example, in the Upper Canyon zone, near Allen Gulch, two sites (24LN1077 and 24LN1078) were recorded in 1976 and a third site (24LN388) was recorded in 1981, but by 1982 more of 24LN388 had been exposed and it then became obvious that it was an extensive and very informative site. Furthermore, during the 1982 survey a fourth site (24LN669) was recorded in the same area. The continuing exposure of previously unidentified sites is even more apparent in the Kootenai Flats area of the Tobacco Plains zone, where some 25 new sites were recorded during the 1982 survey. While these are examples of some immediate and positive benefits to the archaeological record, the longer term effects on cultural resources are clearly negative.

Natural and Cultural Adverse Effects

There are a number of natural processes and cultural factors unrelated to reservoir impoundment that have adversely affected the condition of identified cultural resources. Natural processes include bioturbation, cryoturbation, slow rates of deposition, and poor preservation of organic cultural materials. Cultural factors, primarily logging activities carried out prior to and unrelated to the construction of Libby Dam, also must be added to the list of adverse effects. Agricultural practices along the Kootenai River, especially in the Kootenai Flats area, also must have had adverse affects on the area's cultural resources. In other words, most, if not all, of the identified cultural resources were affected to some degree as a result of one or more of these prereservoir processes and factors. Nevertheless, the relative integrity of most sites undoubtedly was such that they retained more of their potential to contribute significant information to understanding past human behavior than they had after the construction of Libby Dam.

Figure 6-9. Site 24LN701, a medium size historic structure site located in the Tobacco Plains zone. It was razed prior to impoundment; cobbles and scattered historic artifacts remain as evidence.

Figure 6-10. A view of one of the collasped structures at 24LN370, a historic structure site located along the reservoir margin in the Lower Canyon zone.

Historic Structure Sites, N=20 (8.0%)

Sites in this category are characterized by structural remains, usually only foundations, because all standing structures in the drawdown zone were razed in conjunction with reservoir clearing (Figure 6-9). However, several sites, including 24LN370 (Figure 6-10), 24LN380, and 24LN670, are located along the reservoir margin. The structures at these and other logging camps and farm/ranchsteads are either standing or have collapsed. Both standing and collapsed historic structures are also present at aboriginal site 24LN1070, but they are some distance from the reservoir margin. Historic structure sites occur throughout the project area. Half of them are on high terraces and 60 percent are found in the Tobacco Plains zone. With regard to distance from permanent water these sites are more evenly distributed than are aboriginal sites; nine are far from water, seven are at moderate distances and four are near permanent water.

Historic Debris Sites, N=7 (2.8%)

As noted previously, these sites are best described as trash dumps and all are less than 100 years old. Four are situated on middle terraces and two are on low terraces. They occur at various distances from permanent water sources, but four are far from water. All but one of the historic debris sites are in the Tobacco Plains zone; the other one is in the Upper Canyon zone.

Missing Data Sites, N=22 (8.9%)

Almost all of these sites have aboriginal cultural materials, but available information does not allow their assignment to a site type category. They were recorded before 1976.

The information presented thus far in this section has been of a summary nature. Groups of sites defined by particular sets of characteristics have been discussed and selected relationships between site types and environmental settings have been illustrated briefly as means of setting the stage for subsequent discussions. Table 5 in Appendix C provides the reader with a site by site tabulation according to condition, size, depth, and type.

Assessment of Project Effects

A number of agents (e.g., wind, water, plants, and animals, including humans) differentially affect each cultural resource in the reservoir area. General patterns of effects, however, can be recognized and discussed.

The assessment of present site condition presented in Table 5 of Appendix C provides one type of general measure of project effects on

FCR. Presumably, these sites represent short-term, hunting related activities. Most of these sites are on lower terraces (62.5%), and primarily on low dunes (68.75%) in the Tobacco Plains zone. Ten are found more than 300 m from permanent water and only two are closer than 100 m to a permanent water source.

Fire-Cracked Rock Only Sites, N=12 (4.8%)

Except for the absence of bone fragments, sites in this group are like those described in the preceding paragraph. They are characterized either by FCR features or a high density of scattered FCR. While it cannot be said that FCR only sites are unrelated to hunting activities, it is probable that they represent a limited range of activities and/or a very short-term campsite. Consistent with the overall pattern most (66.7%) of these sites are located in the Tobacco Plains zone. However, the lower and middle terraces each contain five FCR only sites and high terraces have only two. Half of these sites are more than 300 m from permanent water and one quarter of them are found within 100 m of permanent water.

Rock Art Sites, N=2 (0.8%)

Both sites in this category--24LN510 and 24LN530--are Upper Canyon zone, aboriginal, pictograph sites recorded by Taylor (1973). Site 24LN510 is located well above the maximum pool level, while 24LN530 is inundated except during drawdowns.

Rock Alignment Sites, N=3 (1.2 %)

These sites are problematic in that it is difficult to determine their cultural affiliations. Site 24LN523 is a "rock enclosure" discovered and tested by Taylor (1973:70-72). This Upper Canyon site was interpreted as a possible Native American vision quest site, but it was recognized that the site could have been built by whites (Taylor 1973). It is also possible that the site served as a hunting blind used either by Native Americans or Euroamericans. The other two sites were recorded in 1976 and are both located near the Kootenai River in the Tobacco Plains zone. Site 24LN1099 is a single course stone feature consisting of a poorly defined circle of rocks with lines of rock projecting from it. According to information on the site form, neither historic nor aboriginal artifacts were found near the feature and its cultural affiliation was unknown. However, considering that the same general area contains many rock alignments directly related to historic field clearing, it is possible that 24LN1099 represents the remains of similar features. Site 24LN1101 is a pile of rocks interpreted as a border marker because it is situated very near the International Boundary and immediately above the maximum pool level.

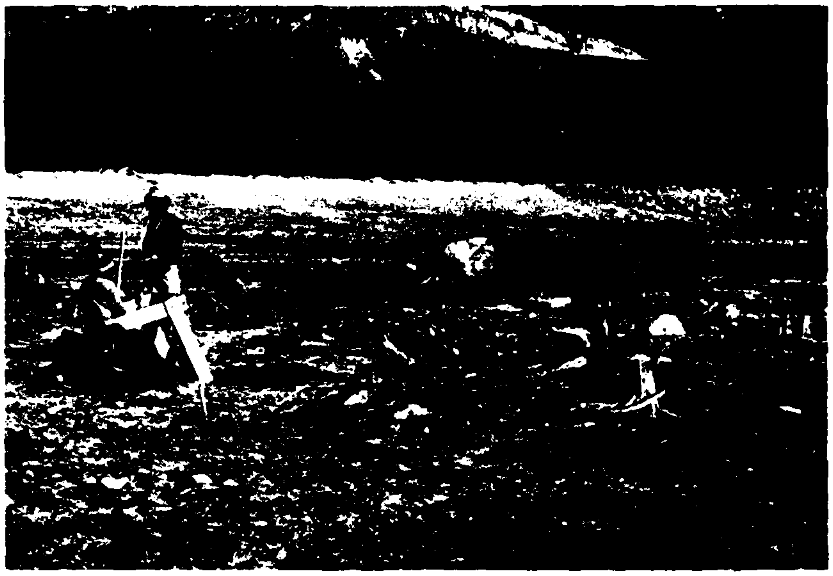


Figure 6-7. Site 24LN392, a large, low diversity site located near Peck Gulch in the Upper Canyon zone.

Figure 6-8. Site 24LN666, a medium size, low diversity site in the Kootenai Flats area of the Tobacco Plains zone. Wire flags denote artifact locations.

CHAPTER 7

LANDFORMS, SEDIMENTS AND ARCHAEOLOGICAL DEPOSITS ALONG LIBBY RESERVOIR

by
Robert R. Mierendorf

The purpose of this chapter is to place cultural resources into geologic, environmental and broad chronological contexts, and to relate these contexts to the study of prehistoric human adaptations within the project area. Processes of erosion, deposition, and landform evolution create substrata for aboriginal subsistence and settlement activities. These substrata are not static, but constantly "interact" with other ongoing geologic processes and with human adaptive strategies. Because of the control exerted on geologic processes and subsistence resources, the timing of climatic changes becomes an important aspect of prehistoric studies.

Four research objectives were defined to guide field investigations relating to environmental and geologic contexts. These were:

1. to map and describe late Pleistocene and Holocene deposits and landforms within the project boundaries (see Appendix G),

2. to correlate stratigraphic units and cultural components between widely spaced sites on nonadjacent landforms,

3. to establish an alluvial chronology for the Kootenai River within the project area,

4. and to relate geologic processes and climatic change to prehistoric land use.

The data base available for study was confined predominately to the reservoir drawdown zone, although reconnaissance level investigations were conducted over a much broader area. Important localities mentioned in this chapter are shown in Figure 7-1. Fieldwork was conducted concurrent with archaeological survey and testing between March and June of 1982. During this time, all landforms below 2,342 feet elevation remained submerged. Within the drawdown zone was exposed an important late Quaternary record consisting of unobscured, denuded landforms, stratigraphic sections, and archaeological sites. However, this record was not uniformily accessible to investigation because shoreline wave cutting, wind reworking, and hillslope erosion of reservoir landforms masks stratigraphic variability, especially at low elevations and along steep slopes.

The following section begins with a brief discussion of radiocarbon dating and tephrachronology in the project area. It provides a general

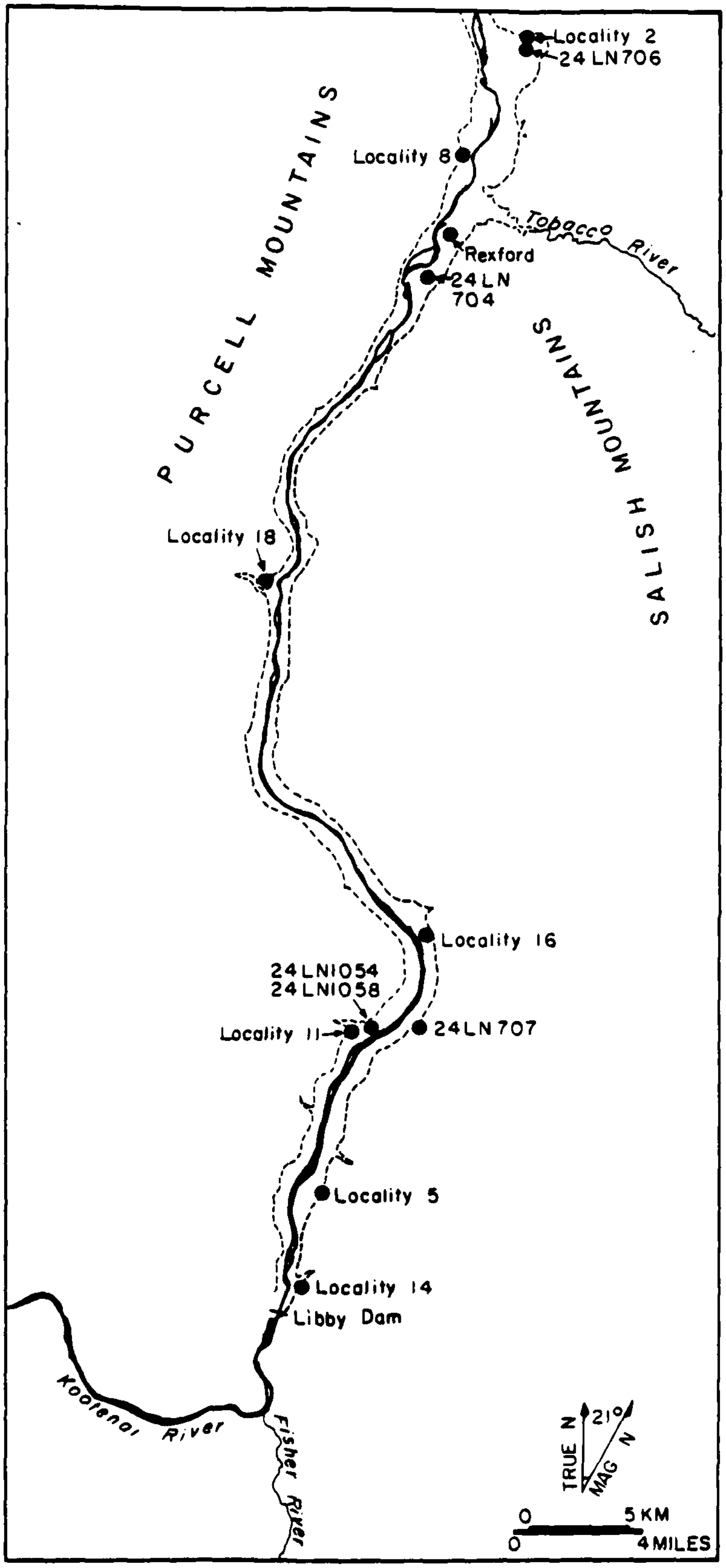


Figure 7-1. Map of project vicinity showing important localities and sites mentioned in the text.

background and explains some of the project-specific problems in obtaining absolute chronologies. A rough draft of portions of this section were written by Bruce Cochran and were subsequently rewritten and reorganized by the author. Next, the geomorphology is discussed with emphasis on landscape formation. The next two sections focus on the stratigraphic and analytical contexts of cultural materials. Results are summarized, discussed and compared to the surrounding region in the last two sections.

Radiocarbon and Tephra Dating of Deposits

A total of four organic samples were submitted for dating to Beta Analytic, Inc. (Table 7-1). Beta-4989 was counted on burned bone from an excavated archaeological feature. The remaining three samples were unassociated with archaeological remains and were used as time markers within measured sections. These samples consisted of charcoal and were removed from vertical exposures of undisturbed deposits. The paucity of dated samples is a function of the scarcity of preserved organic deposits with unambiguous stratigraphic integrity. Appendix H contains detailed locational and stratigraphic information for each sample.

Table 7-1. Radiocarbon Dated Samples from Libby Reservoir Drawdown Zone.

Lab Number	Weight of Counted C	C-14 Age	C-13 Adjusted Radiocarbon Age
Beta-4989	--	3,170±100	3,260±100
Beta-4990	0.28 g	23,550±1,400	23,565±1,400
Beta-5227	0.20 g	8,820±370	8,850±370
Beta-5228	0.25 g	11,590±410	11,730±410

Primary volanic ash layers have been used by archaeologists and geologists as marker horizons for correlating sedimentary sequences and for providing a chronologic framework in which to place geological-climatological and cultural events. This is possible because chemical and mineralogical characreristics provide distinctive "signatures" for many tephra or ash layers. The time of deposition of these layers is usually determined by radiocarbon dating of organic remains found in stratigraphic association with the volcanic ash.

Chemistry of glass shards (based on electron microprobe analysis) and the suite of phenocrysts found in the glass shards (petrographic analysis) have been used by many Quaternary researchers (Wilcox 1965; Powers and Wilcox 1964; Steen and Fryxell 1965; Smith et al. 1968, 1977;

Smith and Westgate 1969; Okazaki et al. 1977; Hyde 1975; Mullineaux et al. 1975; and others cited in Sarna-Wojcicki et al. 1983) to establish sets of characteristics identifying specific tephras. Tables 7-2 and 7-3 summarize petrographic and electron probe data of widespread late Quaternary tephras in the Pacific Northwest.

Electron microprobe analyses (glass chemistry) often cannot distinguish tehra layers from different sources or even the same source. For example, various members of Mount St. Helens set S, ejected over a span of about 1,000 years have overlapping chemistries with respect to Ca:K:Fe proportions (Irwin and Moody 1978:203, 207; Smith et al. 1977:204-205; Mullineaux et al. 1975, 1978). Similarily, these ratios for Glacier Peak Layers B and G closely overlap. However, when comparing the K:Ca and K:Fe ratios, layers B and G become distinctive from each other (Tables 7-2 and 7-3). Because Mount St. Helens set J and S have similar glass chemistries these tephras must be separated by petrographic analysis. Mount St. Helens set S contains cummingtonite, while set J lacks this mineral. Alternatively, the electron probe technique is the only means to separate Mount St. Helens set J and Glacier Peak layers G and B because these tephras are petrographically identical.

A total of 16 volcanic ash samples, 11 from the project area and 5 comparative samples from other areas, were microprobed by Charles R. Knowles, Idaho Bureau of Mines and Geology, University of Idaho. Samples were analyzed for Ca (calcium), K (potassium), and Fe (iron) and the ratios were normalized to 100 percent, plotted on ternary diagrams, and compared to chemical analyses of known tephra layers (Figure 7-2). These samples cluster into five groups (Table 7-4) which are compared to chemical data of known tephras.

Samples LRP 1, 2, 7, 8, 10, 11, 12, and 17 comprise one group. Ternary diagram plots of Ca:K:Fe ratios are similar if not the same as those attributed to Mount Mazama tephra. Petrographic analysis of samples LRP 7, 8, and 17 shows a phenocryst suite consisting of hypersthene, clinopyroxene (augite?) green and brown hornblende, plagioclase, and opaque oxides. Refractive indices of the volcanic glasses varies between 1.502 and 1.512. However, most glass shards group between 1.506 and 1.508. Several lithic fragments consisting of hypocrystalline material probably originated at the vent and may represent older volcanic debris. These fragments clearly are not associated with nonvolcanic materials. Glass refractive index and phenocryst suite of samples LRP 7, 8, and 17 are identical to the phenocryst suite and refractive indices (N) of tephra attributed to the 6,700 B.P. eruption of Mount Mazama (Table 7-2).

Although sample LRP-9 has the same phenocryst suite and glass refractive index as the above samples, the electron microprobe data are anamolous. Although this anomaly cannot be explained, it may be that this ash is assignable to Mt. Mazama tephra layer O because: (1) its phenocryst suite is the same as layer O; (2) its stratigraphic position is similar to the other samples from the project area attributable to layer O; (3) it overlies a prominent paleosol which in turn correlates

Table 7-2. Summary of Provenience (source vent) Data, C-14 Age, and Petrographic Characteristics of known, Widespread Late Quaternary Tephras in the Pacific Northwest that May Occur in the Kootenai Region; Arranged Chronologically.

Vent	Tephra Set or Name	14-C Age and Lab	Phenocryst Suite	N of Glass	Reference
Mount St. Helens	Set S	13,650±400;W3136 11,900±300;W2866	Cummingtonite, hornblende, hypersthene, plagioclase, opaque oxides	1.498-1.501	Mullineaux et al. 1975, 1978; Hyde 1975
Mount St. Helens	Set J[a]	11,880±350;W2441 8,300±350;W2587	Hypersthene,[b] hornblende, plagioclase, opaque oxides	1.496-1.501[b]	Mullineaux et al. 1975, 1978; Hyde 1975
Glacier Peak	G	≃12,000±310;WSU155 ≃12,750±350;W1644	Hypersthene,[b] hornblende, plagioclase, opaque oxides	1.498-1.501[b]	This report; Cochran unpublished laboratory data
Glacier Peak	B	≃11,200±100;WSU1554 ≃11,300±230;WSU1548	Same as[b] G	1.498-1.501[b]	Mehringer et al. 1977; This report; Cochran unpublished laboratory data
Crater Lake (Mount Mazama)	O	ca 6,700[c]	Hypersthene,[b] clinopyroxene (angite?), hornblende, plagioclase, opaque oxides	1.502-1.512[b]	This report; Cochran unpublished laboratory data
Mount St. Helens	Y	3,900±250;W2677 3,350±250;W2677	Cummingtonite, hornblende, biotite, opaque oxides	1.498-1.501	Mullineaux et al. 1975
Meager Mountain	Bridge River (BR)	2,070±80;GSC1939 1,860±70;GSC1950	Hypersthene,[b] clinopyroxene, hornblende, plagioclase opaque oxides	1.496-1.502[b]	Mathews and Westgate 1980; This report

[a] Several beds of Set J span ca 3,000 years.

[b] Phenocryst suite and glass N data from samples collected in the study area.

[c] Average of dates from many localities in the Pacific Northwest; accepted by most Quaternary scientists.

Table 7-3. Averages of K:Ca and K:Fe Ratios of Mount St. Helens, Glacier Peak, and Mount Mazama Tephras.

Vent	Tephra Set or Name	K:Ca	K:Fe	Number of Analyses
Mount St. Helens	S	1.6	2.0	6
	J	1.8	1.9	4
Glacier Peak	G	3.0	3.4	10
	B	2.5	2.8	7
Mount Mazama[b]	O	1.9	1.4	11

[a]After Smith et al. (1977) and Irwin and Moody (1978), arranged chronologically.

[b]Cochran unpublished laboratory data.

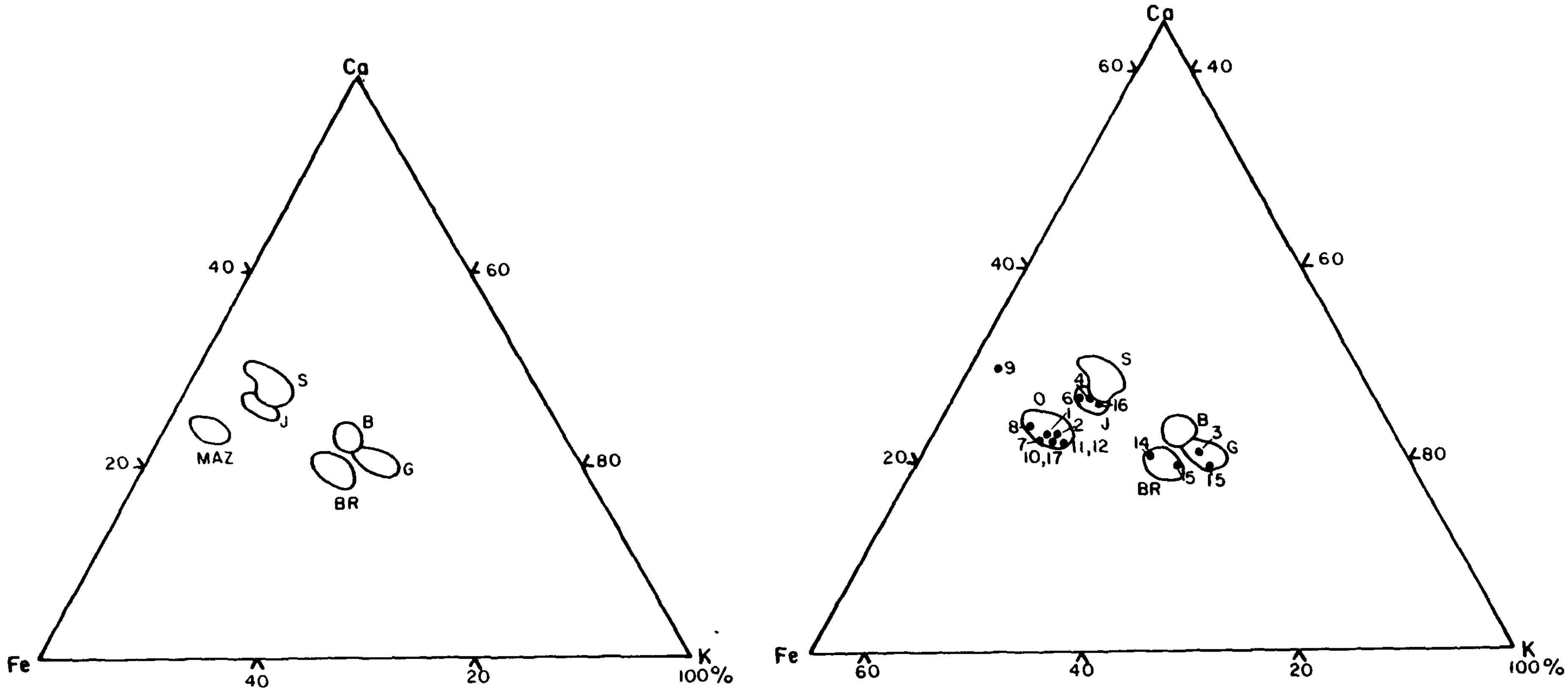


Figure 7-2. Ternary diagrams of Calcium:Potassium:Iron ratios (normalized to 100%) from electron microprobe analysis of primary tephras. Left diagram: plots of six common tephra deposits found in the Northwest, based on published data from various sources; sets S and J are from Mount St. Helens; sets G and B are from Glacier Peak; BR is from the Meager Mountain area of British Columbia; MAZ is from Mount Mazama (Crater Lake, Oregon). Right diagram: plots of primary tehpra samples from Libby Reservoir; sample numbers correspond with those in Table 7-3. Note: due to the high relative proportion of K, the high percentage ends of the Ca and Fe scales are omitted from the diagrams.

Table 7-4. Electron Microprobe Analyses of Primary Tephra Beds in the Kootenai Region.

Sample Number	Locality[a]	% Ca	% Fe	% K	Σ = 100% Ca	Σ = 100% Fe	Σ = 100% K	Ratios of K:Ca	Ratios of K:Fe	Tephra Set or Name
LRP-4	L14	1.01	0.99	1.75	27	26	47	1.7	1.8	J
LRP-6	L16	1.02	1.00	1.70	27	27	46	1.7	1.7	J
LRP-16	L5	0.93	0.93	1.75	26	26	48	1.9	1.9	J
LRP-3	L14	0.81	0.76	2.31	21	19	60	2.9	3.0	G
LRP-5	L16	0.84	0.87	2.45	20	21	59	2.9	2.8	G
LRP-15	L5	0.78	0.74	2.53	19	19	62	3.2	3.4	G
LRP-1	24LN706	1.11	1.55	2.12	23	32	45	1.9	1.4	O
LRP-2	24LN706	1.03	1.42	2.06	23	31	46	2.0	1.5	O
LRP-7	24LN704	1.04	1.52	2.13	22	33	45	2.0	1.4	O
LRP-8	L2	1.14	1.56	2.07	24	33	43	1.8	1.3	O
LRP-17	L2	1.06	1.51	2.23	22	32	46	2.1	1.5	O
LRP-10[b]	Pasco,WA	1.05	1.53	2.20	22	32	46	2.1	1.4	O
LRP-11[b]	Pasco,WA	1.06	1.49	2.22	22	31	47	2.1	1.5	O
LRP-12[b]	Pasco,WA	1.02	1.46	2.16	22	31	47	2.1	1.5	O
LRP-9	L8	1.76	1.60	1.99	33	30	37	1.1	1.2	?
LRP-14	Jasper, B.C.	0.98	1.13	2.60	21	24	55	2.7	2.3	Br

NOTE: Calcium (Ca), iron (Fe), and potassium (K) relative % have been normalized to equal 100%.

[a]See location map (Figure 7-1).

[b]Analyzed for comparative purposes.

with a nearby paleosol from locality 2, radiocarbon dated to 8,850±370 B.P. (Beta-5227), and overlain by Mazama ash (see samples LRP-8 and LRP-17).

Recent evidence indicates that the eruption of Mount Mazama consisted of more than one eruptive event. Mack et al. (1979) report two petrographically distinctive Mazama tephras from Bonaparte Meadows in the Okanogan Highlands of Washington. These tephras are separated by about 50 cm of lacustrine sediment and have contrasting radiocarbon ages. The upper tephra dates between 6810+190 (TX 2882) and 6930+110 (TX 2883) whereas the lower tephra has a lower limiting age of 8300±80 (TX 2884 in Mack et al. 1979). Evidence from other localities in the northwestern United States also suggests multiple eruptions (see Sarna-Wojcicki et al. 1983). It is thus possible that the tephra layer represented by sample LRP-9 belongs to one of these events.

Samples LRP-4, LRP-6, and LRP-16 are petrographically and petrochemically similar (Table 7-4). Based upon electron probe analysis the samples are assignable to either Mount St. Helens Set S or set J. However, because the tephras lack cummingtonite and contain phenocrysts of hypersthene, hornblende, plagioclase, and opaque oxides, they are attributed to Mount St. Helens set J or Glacier Peak layers B and G. In order to provide an independent check on the absence of cummingtonite, samples of this tephra were submitted to Franklin F. Foit, Jr. of the Department of Geology, Washington State University. Optical and microprobe examination of samples confirmed the absence of cummingtonite. Less than 0.5 percent of one sample contained crystals similar to hypersthene, anthophyllite, or cummingtonite. Absence of cummingtonite and K:Ca and K:Fe ratios support the liklihood that the tephras are assignable to Mount St. Helens set J ejected between 11,880±350 B.P. and 8,300±350 years B.P. based on radiocarbon dates from deposits near Mount St. Helens (Mullineaux et al. 1975; Hyde 1975). Because of its stratigraphic position immediately below another tephra assignable to Glacier Peak layer G, which predates 11,200 B.P., this ash probably belongs to a post-11,800 but pre-11,200 eruption of Mount St. Helens. This appears to be the first reported identification of St. Helen's tephra set J in northwestern Montana with the previous most distal set J locality being Lind Coulee in eastern Washington (Sarna-Wojcicki et al. 1983:66).

A third tephra represented by samples LRP-3, LRP-5, and LRP-15 occurs in the field between 10 and 45 cm above set J tephra (Figure 7-3). Both tephras form a couplet throughout the lower 17 miles of the reservoir where they occur in the same depositional environment at each locality and appear to be temporally separated by tens or hundreds of years (Figure 7-3). This stratigraphic relationship (Glacier Peak overlying St. Helens J) has been reported previously only for eastern Washington (Moody 1977). The upper tephra is assigned to Glacier Peak Layer G on the basis of Ca:K:Fe proportions, and K:Ca and K:Fe ratios (Tables 7-3 and 7-4). Petrographically, sample LRP-16 was identical to LRP-15. Glass refractive index ranged between 1.498 and 1.502 and the phenocryst suite contained the same minerals as set J. These data are in close agreement with published analyses of Glacier Peak G tephra from other localities in the Northwest (Smith et al. 1977; Porter 1978).

Figure 7-3. Volcanic ash couplet from Locality 5. The lower is assigned to St. Helens set J and the upper to Glacier Peak set G. The meter scale is marked in decimeters.

Early published estimates of the radiocarbon age of Glacier Peak layer G tephra vary between 12,000±310 years B.P. (Fryxell 1965) and 12,750±350 years B.P. (Ives et al. 1967; Lemke et al. 1975). Recently published data indicate that Glacier Peak layer G is no younger than about 11,200 B.P. (Mehringer et al. 1984).

Tephra originating from the Meager Mountain area (i.e., Bridge River tephra) in British Columbia may form a primary deposit within the project area, but the southeastern lobe which could extend to the Middle Kootenai area is not as extensive or as thick as the lobe that trends due east (Mathewes and Westgate 1980). To confirm whether any of the recovered tephras originated from Meager Mountain, a sample of Bridge River tephra was sent by Roger King, University of Western Ontario (Sample LRP-14). From the electron probe data this sample comprises its own group (Table 7-4). Petrographically the sample is distinctive from Mazama tephra O but is similar to St. Helens set J and Glacier Park layers G and B. Tephra layers in the project area do not appear to be derived from the Meager Mountain source.

At this point, the reader may refer to Appendix G and Figures 7-4, 7-5, 7-6, and 7-7 for a technical description of geologic deposits within the project area.

Kootenai Valley Terrace Formation

To even casual visitors to the Kootenai River Valley, one of the most prominent physiographic features is the series of flat-lying, terrace-like landforms stacked against the valley walls. A large portion of the recorded cultural resources within the project area are located on these terraces. This section examines terrace formation processes along the Kootenai River between Libby Dam and the International Boundary as these relate to the project goals no. 3 and no. 4 specified in the introduction to this chapter. What, for example, is the relationship between prehistoric settlement patterns and landscape evolution during the time that the area was available for occupancy? Is it possible that various processes of landscape evolution may constrain aboriginal settlement location and resource procurement by conditioning resource distribution? Secondly, what is the role of climatic change? Terrace formation is a response to hydrologic variables which are partially dependent on regional climate, so that the chronology and origin of terraces may serve as an indicator of changing climate during the late Pleistocene and Holocene.

Methodology

Before investigating terraces in the project area, three major problems were identified. The first is that a number of lower terraces are permanently covered by the water, even during the lowest spring drawdown. Secondly, the region supports forest vegetation that obscures most landform boundaries and features. The only exception is the

reservoir drawdown zone, which has been entirely cleared of vegetation. Finally, the size of the project area dictates that landform correlation take place over a large geographic area, wherein once continuous landforms now appear as isolated remnants separated by expanses of valley wall or bedrock spurs.

In order to overcome these problems, investigation of terraces was implemented in two stages. The first of these involved the creation of a preliminary longitudinal profile of Kootenai River Valley terraces between Libby Dam and the International Boundary, using detailed topographic maps. The second stage, conducted concurrently with reconnaissance level landform mapping and stratigraphic studies, involved field examination and lateral tracing of the terraces drawn on the preliminary longitudinal profile. Field correction resulted in the removal from the preliminary profile of some terrace remnants that were actually bedrock benches. The following section explains procedures used to construct the Kootenai River valley longitudinal profile.

Kootenai River Valley Longitudinal Profile

The base map used for this purpose is a blueline topographic map of the Kootenai River Valley between the United States-Canadian border and Libby Dam. This map is on file at the U.S. Army Corps of Engineers, Seattle District, District File No. E-53-1-151, and is dated 1972. The original is at a scale of 1":400'; a reduced copy with a scale of 1":800' was used for this project. The contour interval is 10 feet.

On this map, the north-south length of the Kootenai River was divided into half-mile sections and conforms to the survey tracts established by Jermann and Aaberg (1976). These tracts were marked consecutively on the abscissa of a graph, with a scale of elevation in feet above sea level on the ordinate of the graph (Figure 7-8). Within each half-mile tract, the location of all terraces visible on the contour map were plotted with a dot at the corresponding elevation. In those cases where the spacing of contour intervals indicated a slightly sloping landform, the high and low elevation values were averaged and the landform was considered a terrace until the diagram could be field corrected.

After all terrace remnants were plotted as dots, solid lines were used to connect correlative terrace segments. Correlation began with the lowest (youngest) terraces and proceeded to the highest (oldest) terraces. Correlation is considered reliable for the youngest terraces because they are the most common, the least modified post-depositionally, and they are laterally more continuous. However, with increasing age and elevation, reliability of correlations decreases substantially, requiring field examination to achieve an acceptable degree of reliability. Terraces were then numbered beginning with the Kootenai River floodplain that was extant prior to inundation by the reservoir. Although terraces 1-4 (T1-T4) were not fully exposed during the 1981-1982 field season, lower terraces immediately below Libby Dam have been studied as part of the LAURD project and are discussed by Cochran and Leonhardy (1982).

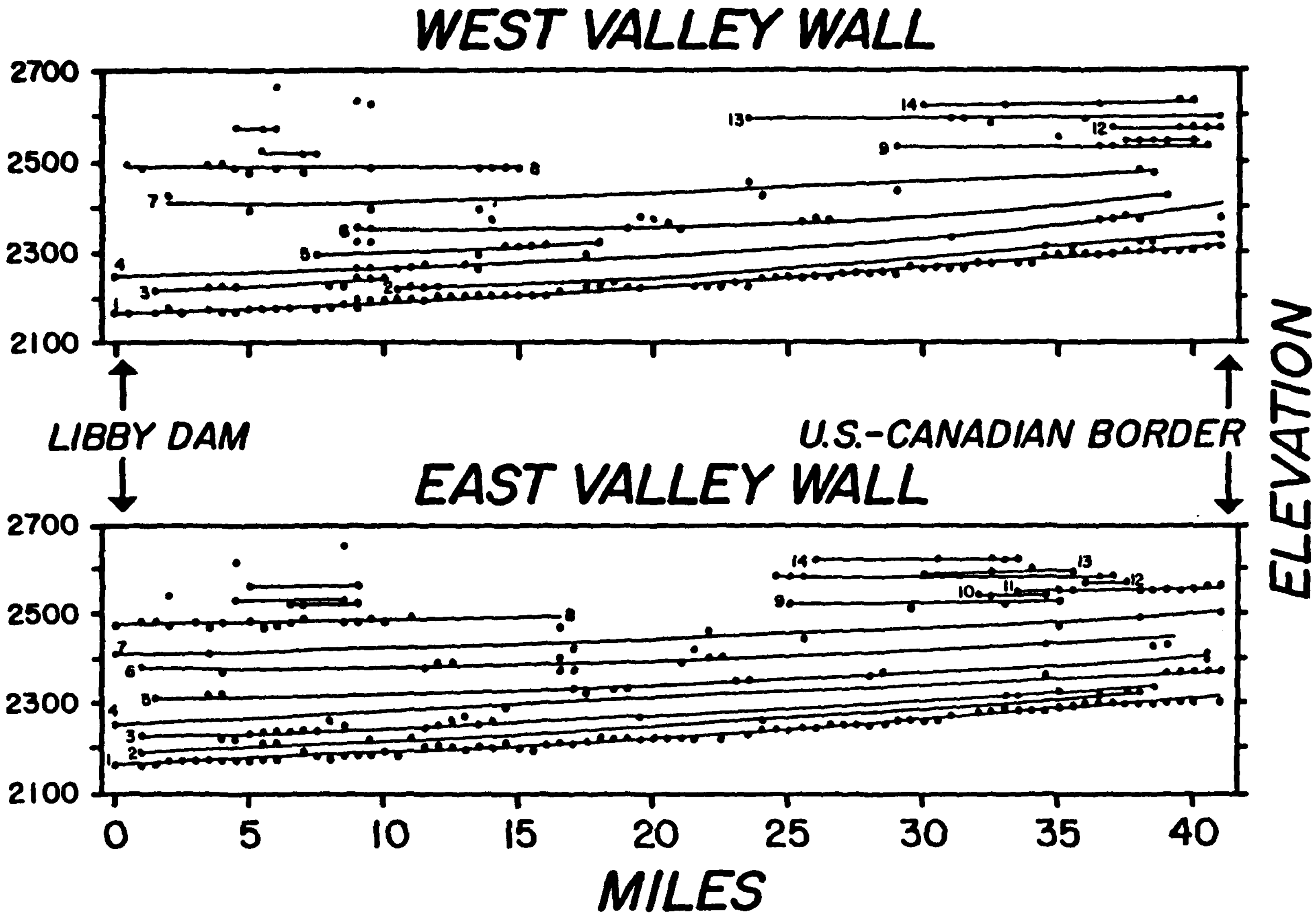


Figure 7-8. Longitudinal profile of terrace-like features along the Kootenai River valley behind Libby Dam.

Types of Terrace Formations

The longitudinal profile (Figure 7-8) depicts three sedimentologically distinctive terrace-like landforms: Kootenai River fluvial terraces, kame and outwash terraces, and paraglacial fan deposits. Note on Figure 7-8 that terrace correlations were performed independently for the east and west sides of the valley.

Kootenai River Terraces

Terraces 1-7 (T1-T7) in Figure 7-8 were formed by floodplain deposition as the Kootenai River downcut through deep, valley fill sediments. This process began shortly after deposition of the primary tephra couplet about 11,500 years ago. In numerous localities throughout the southern 17 miles of the study area, this tephra couplet occurs as a primary deposit capping glaciolacustrine silts and clays and is interbedded with fine deltaic sands graded to the level of a lake. This is the inferred Glacial Lake Kootenai mapped by Alden (1953), Richmond et al. (1965), and Waitt and Thorson (1983).

As the Kootenai River cut through Glacial Lake Kootenai deposits and other valley fill, it followed a braiding channel pattern and built numerous channel bar complexes. As the channels shifted, floodplain remnants especially those downstream of prominent bedrock spurs, were abandoned and preserved as relict features. On many of these preserved floodplain surfaces can be seen channel and bar forms resembling those described by Clague (1975c) immediately north of the project area. Prior to abandonment, each floodplain was subjected to episodes of alluviation followed by intervals of subaerial exposure, stabalization, and sparse plant growth. Sometimes the vegetated surfaces were burned and subsequently capped by successive fluvial deposits. At the mouth of Bristow Creek, for example, a 5.3 m thick fluvial cap containing at least three burned surfaces, unconformably overlies glaciolacustrine and glaciofluvial sediments. A radiocarbon date of 11,730±410 B.P. (Beta-5228) was obtained from charred plant remains collected from the earliest burned surface within the basal alluvium of T7 terrace overlying this same unconformity.

As downcutting progressed, lateral migration of the Kootenai channel became increasingly controlled by bedrock features and prominent alluvial fans accreting at the mouths of major tributaries. Based on a radiocarbon date of 8,170±100 B.P. (TX-3220, reported in Rice 1979; Munsell and Salo 1979) from below the modern floodplain just downstream of Libby Dam at the mouth of Dunn Creek, it is known that the Kootenai River channel attained its present elevation prior to about 8,200 years ago. Therefore, by relating the Kootenai River to the elevation of the primary volcanic ash couplet and the C-14 date of about 8,200 B.P., it can be estimated that in the southern portion of the study area at least, the Kootenai River entrenched through 320 feet of valley fill over a period of approximately 3,300 years, yielding a mean downcutting rate of nearly 0.1 feet/year.

capped the old abandoned river terraces and in the uppermost portion of alluvial fan deposits, some of which appear to predate the Mazama ash fall.

Regional Comparisons

The Kootenai River is the second largest tributary of the Columbia River, with the Snake River being the largest. Because much archaeological research has been conducted along the lower Snake and middle Columbia rivers, it is useful to compare the geologic context of archaeological sites in these regions with those of the Kootenai River.

An important difference between drainage basins is in the factors controlling broad patterns of stream flow. For the Kootenai River and the Columbia River above the mouth of the Snake River, 80 percent of yearly runoff is derived from glacier and snowfield meltwater. During the late-Pleistocene and Holocene, the Columbia River system above the mouth of the Snake River drained nearly all of the Cordilleran ice sheet east of the Cascade Mountains and west of the Continental Divide and numerous alpine ice fields and caps, as well as extensive alpine glacier systems in northern Washington, northern Idaho, western Montana, and southern British Columbia. By comparison, the Snake River drained no portion of the Cordilleran ice sheet and it drained only restricted, isolated alpine glacial systems of central and southern Idaho, extreme northeastern Oregon, extreme southwestern Montana, and a small portion of northwestern Wyoming. These differences are likely to have been reflected in the alluvial chronologies of the two drainage basins (Mierendorf 1984) which in turn affect the river-marginal landscape that is used for subsistence and habitation activities of people (Mierendorf 1983). The importance of mountainous landscapes to Northwest alluvial chronologies has been affirmed in a recent review article:

> It seems unlikely that Holocene changes in vegetation caused major adjustments in fluvial activity. In contrast, the direct effects of changes in temperature and precipitation probably influenced the physical behavior of many rivers that drain high-elevation landscapes (Knox 1983:37).

When the geologic context of the earliest archaeological sites in the Columbia River (above the mouth of the Snake) and Snake River are compared, a possible pattern emerges. Along the well-studied middle and upper Columbia River reaches, sites have not been radiocarbon dated earlier than about 8,200 years ago. This is in contrast to the Snake River drainage, where the earliest well-dated sites along the lower Snake and Clearwater rivers (Marmes and Hatwai) have radiocarbon ages of between 10,500 and 11,000 years (Fryxell et al. 1968; Ames et al. 1981; Sheppard et al. 1984) and in the Snake River Plain of southern Idaho some sites (Wilson Butte and Wasden caves) have radiocarbon dates between 11,000 and 15,000 years ago (Gruhn 1965; Butler 1978). It is significant to note here that the early Windust Phase (Leonhardy and Rice 1970; Rice 1972) assemblages at the Marmes and Hatwai sites were

3. Correlation of microstratigraphy between widely spaced sites is complicated by numerous unconformities of erosion or nondeposition. Many of these are not correlative and probably reflect local environmental controls.

4. On all landforms, deposition and weathering rates in the past were nonuniform, resulting in numerous buried soil horizons.

5. Cultural remains were never found associated with or below the buried soil horizons, suggesting ephemeral use or no use of these portions of the landscape by prehistoric people.

Summary and Discussion

The earliest deposits mapped within the project boundaries date to the last, southernmost advance of the Cordilleran ice sheet, sometime between 18,000 and 15,000 years ago. One restricted occurrence of Olympia Interglacial deposits which preceded this advance was dated to about 23,500 years ago. During this advance, the project area was covered with thousands of feet of glacial ice which flowed south from mountains in British Columbia. Sometime around 15,000 years ago, climatic changes caused this ice mass to slowly waste away and deglaciation of the landscape began. Deglaciation as accompanied by outpourings of great volumes of meltwater south of the ice lobe, resulted in thick, gravelly outwash stream deposits and finely bedded, silt and clay lake deposits. The deposition of a volcanic ash couplet just above such glaciolacustrine deposits and dating to about 11,500 years ago indicates by that time most of the ice sheet had disappeared from at least the lower 17 miles of the project area. After about 11,500 years ago, the proglacial outwash streams, which still drained ice fields in British Columbia, began downcutting through glacial deposits that deeply filled the Kootenai Valley. This period of adjustment left flat-lying terrace remnants stacked against each valley wall. Before 8,200 years ago, the Kootenai River had downcut to at least its modern level. The river probably did not downcut significantly deeper than this as evidenced by bedrock exposures at numerous locations within the modern Kootenai River channel. Once this modern level of the river had been reached, other valley processes that were controlled by the Kootenai River's level, such as cutting of tributary canyons and alluvial fan deposition, tended to become stabilized. The most active (i.e., unstable) portions of the landscape after this time were along the narrow Kootenai River floodplain and within the Kootenai Flats dune field. The earliest human use of this landscape is suspected to have begun sometime around 9,000-8,000 years ago. Based upon evidence from archaeological studies below the reservoir, the earliest demonstrated human use of the valley was between 8,200 and 6,700 years ago. This is based on "a small assemblage of nondiagnotic material" recovered from 24LN1046 (below Libby Dam) between a primary deposit of Mazama ash and the radiocarbon date of 8,170±100 B.P. (Rice 1979:33). However, within the boundaries of this project area, archaeological remains were found only in the aeolian sands that

and often show a reaction to HCl because carbonates have not been leached from even the upper soil horizons. These deposits date from as early as 4,000-2,000 years ago to historic times.

The next type of deposit (PMI) is also post-Mazama in age because it overlies a primary Mazama tephra layer or contains Mazama glass shards. These deposits are recognized in the field by their nearly uniform reddish hue, which is the product of weak illuvial iron accumulation (soil Bir horizons) and thin iron-rich lamellae from short periods of impeded drainage. These units lack abrupt lower boundaries and can be difficult to recognize if their upper portions have been eroded. Age is between 6,700 and 2,000-4,000 years ago.

The next lower deposits (AMII) underlie primary Mazama tephra or lack Mazama glass shards. These deposits are strongly to moderately mottled with reddish-hued iron oxide accumulations within a weakly gleyed matrix. There is strong development of clayey, iron oxide-rich bands and on higher (older) terraces, are basin and wedge-shaped features possibly related to impeded drainage caused by frozen ground sometime in the past. On lower (i.e., younger) terraces, the basin and wedge-shaped features were not observed but the iron bands were present. The upper and lower boundaries are not always clearly visible, and such deposits are most often in the position of the developing soil BC horizon. Estimated age is between the early post-glacial (roughly 9,500 years ago) and 6,700 years ago.

The final analytic unit (AMI) consists of early Holocene fluvial sands. These deposits are stratified to unstratified and are high in carbonate content because they are below the depth of leaching under the modern soil forming climate. Iron oxide and clay-rich bands and Mazama glass shards are lacking. These deposits built the first potentially stable surfaces available for human occupation within the confines of the project area (i.e., below the upper margin of the reservoir). However, erosional unconformities usually mark the upper boundary and separate depositional episodes within such deposits. The upper portions of AMI deposits are penetrated by modern tree root systems and usually constitute the modern soil C horizon.

The distribution of analytic units within the project area is shown in a sectional correlation diagram (Figure 7-10). The sections are from representative profiles recorded at tested archaeological sites. Profiles are grouped according to landform type: dune, terrace, and fan. A number of stratigraphic relationships are shown in Figure 7-10, which shows the inferred depositional environment of stratigraphic units and soil horizons using soil morphological symbols (Soil Survey Staff 1981). These are:

1. The predominance and thickness of AMII and PMII deposits in dunes reflects their continued growth in the Tobacco Plains zone throughout the Holocene.

2. By comparison, aeolian sands (PMI and PMII deposits) on most terraces and fans accreted at a slower rate.

Site 24LN707

The small proportion of Mazama glass shards found in the upper 25 cm of this profile are of uncertain significance because the artifacts occur within a solifluction deposit. Solifluctuation appears to have been active before and after the time of the Mazama eruption in this environment, and when the source of the solifluction sediments is till, as in this case, the presence or absence of Mazama glass shards is not sufficient for relative dating. Pre-Mazama age fluvial and possibly aeolian sands underlie the solifluction deposits, but artifacts were not excavated from these deposits.

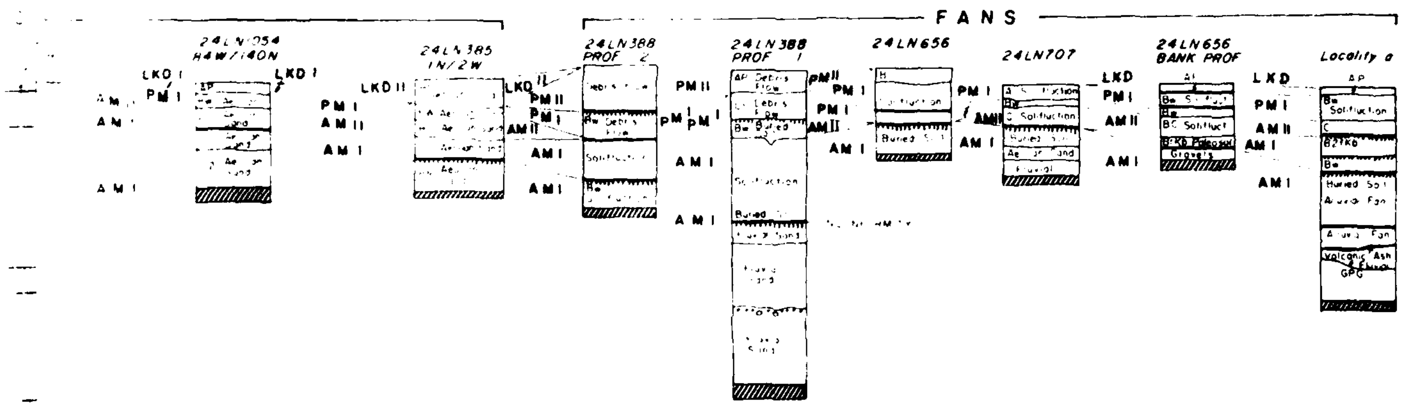
Analytic Units and Archaeological Assemblages

In order to address the previously noted problems of postdepositional mixing, erosion, deposition, and loose chronological control, while attempting to correlate assemblages between widely separated sites, a series of six analytic units were created. These consist of a simple classification of deposits based upon the locational integrity of the artifacts they contain and the broad time periods to which these deposits can be assigned. These analytic units are independent of the depth below surface, the type of landform, and the type of deposit. They are described next as if the entire sequence was represented in a single profile, beginning at the surface and proceeding to increasing depth.

Lake Koocanusa deposits (LKDII) are a result of reservoir controlled depositional processes. Where they occur, these form the ground surface and are post-1973 in age. These deposits formed under wave action and reservoir currents or from exposure to wind during drawdowns. They are thinly laminated, have a high charcoal and organic matter content, and are entirely leached of carbonates. The artifacts contained in these deposits have been removed from their prereservoir sedimentary context and lack "integrity" as defined in the criteria for evaluation for the National Register of Historic Places.

A second type of Lake Koocanusa deposit (LKDI) results from disturbance of in place, naturally occurring sediments. Agents of disturbance are predominantly related to vegetation clearing prior to reservoir inundation, including logging, brush clearing, piling and burning of debris, but also include reservoir currents and wave action. These deposits are anolagous to plowzones in that artifacts within them are disturbed, but have not been transported far from their original context. The underlying deposit always consists of an intact, natural sedimentary unit, although erosion may have "lagged" LKDI artifacts onto this lower surface.

Relatively recent aeolian sediments (PMII) are recognized by the weak expression of soil development and the presence of glass shards attributable to the Mount Mazama source. Unlike older aeolian sands, these deposits lack the red hues associated with iron oxide accumulation



... and inferred depositional environments at key archaeological ... to landform type.

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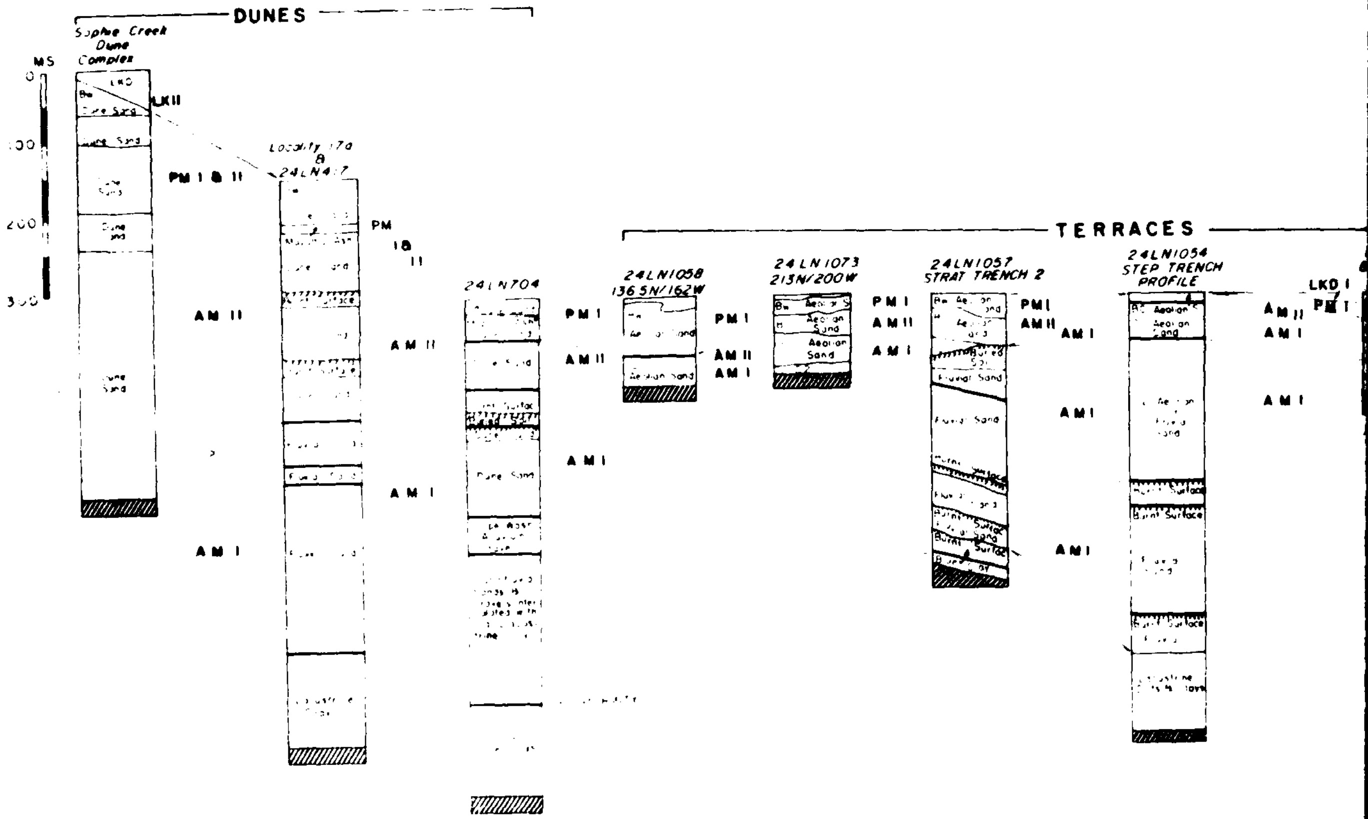


Figure 7-10. Serial section diagram of analytic units and i
sites in Libby Reservoir, grouped according to

1 of 2

Table 7-5. Percentage of Mazama and Non-Mazama Volcanic Glasses from Sedimentary Sequences at Sites 24LN1054, 24LN1058, 24LN704, and 24LN707; Based on 2,000-5,000 Grain County/Sample.

Site and Grid Number	Sample Number	% Mazama Volcanic Glass	% Non-Mazama Volcanic Glass	Total %
24LN1054 104N/84W	1	1.18	0.67	1.85
	2	3.28	0.61	3.89
	3	1.51	0.85	2.36
	4	4.07	0.52	4.59
	5	2.77	0.69	3.46
	6	2.99	0.53	3.52
	7	2.96	0.63	3.32
	8	3.39	0.50	3.89
	9	1.44	0.53	1.97
	10	1.99	0.49	2.48
	11	1.49	0.25	1.74
	12	0.00	0.03	0.03
	13	0.00	0.00	0.00
	14	0.00	0.17	0.17
	15	0.00	0.17	0.17
	16	0.00	0.00	0.00
	17	0.00	0.00	0.00
24LN1058 176N/206W	J	2.01	0.55	2.56
	I	0.81	0.00	0.81
	H	3.59	0.00	3.59
	G	0.53	0.00	0.53
	F	0.00	0.14	0.14
	E	0.00	0.21	0.21
	D	0.00	0.00	0.00
	C	0.00	0.00	0.00
	B[a]	1.67	0.21	1.88
	A	0.00	0.00	0.00

Table 7-5. Continued

Site and Grid Number	Sample Number	% Mazama Volcanic Glass	% Non-Mazama Volcanic Glass	Total %
24LN704 110N/107W	11	3.07	0.40	3.47
	10	2.14	0.37	2.51
	9	2.84	0.31	3.15
	8	3.86	0.44	3.80
	7	76.70	3.16	79.86
	6[b]	8.27	1.41	9.68
	5	0.16	0.09	0.25
	4	0.00	0.00	0.00
	3	0.00	0.00	0.00
	2	0.00	0.00	0.00
	1	0.00	0.00	0.00
24LN707 82N/79E	2	1.14	0.03	1.17
	3	0.13	0.04	0.17
	4	0.00	0.00	0.00
	5	0.00	0,00	0.00
	6	0.00	0.00	0.00
	6[a]	0.00	0.00	0.00
	7	0.18	0.00	0.18
	8	0.00	0.00	0.00
	9	0.00	0.00	0.00

NOTE: Stratigraphic order is maintained with sample numbers corresponding to appropriate stratigraphic figure. Dashed lines represent major unconformities.

[a]Sample extracted from krotivina.

[b]Sample collected close to erosional unconformity.

profile can be affected by burrowing rodents, insects, worms, tree throws and root penetration, and normal soil translocation processes. Complete homogenization of pre-Mazama and post-Mazama sediments would hypothetically result in a uniform vertical distribution of Mazama glass shards. However, the few data presently available for the project area (Table 7-5) and similar environmental settings (Cochran 1984) indicate increasing Mazama glass shard content near the surface and in the same stratigraphic position at widely spaced sampling localities. This provides some evidence that the technique may discriminate between pre-Mazama and post-Mazama deposits. Table 7-5 shows the Mazama glass shard content for sediment samples from four archaeological sites within the project area. Figure 7-10 (part of the next section) shows profiles from the various sites discussed in the following paragraphs.

Site 24LN1054

The abrupt appearance of Mazama glass shards at sample 11 (Table 7-5) marks the possible boundary between pre-Mazama and post-Mazama deposits. This corresponds with a prominent and ubiquitous unconformity between brown, carbonate-rich fluvial sands (the modern soil C horizon) and overlying yellowish brown, carbonate-leached aeolian sands in which a BC soil horizon has developed. A limited number of artifacts excavated from below this unconformity indicate pre-6,700 B.P. utilization of the site.

Site 24LN1058

The appearance of Mazama glass shards occurs approximately between samples G and H. This corresponds with a modern soil boundary separating a weakly developed color B horizon from the underlying BC horizon, which is transitional in properties to the soil C horizon. At 24LN1054, the BC horizon contains Mazama glass shards. These differences could be caused by mixing or they could reflect modern soil development in two different aeolian parent materials. In either case, a small assemblage of artifacts was excavated from pre-Mazama age sediments at 24LN1058.

Site 24LN704

Here, a discontinuous layer containing redeposited volcanic ash could be traced across some portions of the site. A "pure" chunk of this sample was identified (Table 7-4, LRP-7) as belonging to Mount Mazama layer O. Mazama glass shards first appear in the carbonate-rich soil C horizon below this ash indicating mixing of Mazama glass shards in these aeolian sands prior to redeposition of the larger ash chunks, probably derived from upslope. This redepositional episode may have occurred thousands of years after the primary Mazama ash fall. Artifacts excavated from this site occur only within the post-Mazama sediments.

wood charcoal (predominantly from burned tree roots). It was recognized early during field work that a number of postdepositional processes contributed to vertical homogenization of these upper deposits and possibly of the associated artifacts. The most important of these mixing processes are mass sediment displacements through tree throw and vertical displacement of particles through normal tree root growth and from freeze-thaw cycles. The cumulative effect of such processes operating over nearly 10,000 years of continuous forest growth must be emphasized. Also, reservoir clearing and operation alters the stratigraphic context of archaeological resources in two basic ways. First, reservoir-related erosion truncates upper soil horizons and depositional units. For example, in major portions of many sites, the uppermost soil horizon consists of the lower B or the BC because the O, A, and portions of the B horizons have been eroded. Artifacts on or in the top of these horizons must be interpreted with caution. A second type of post-reservoir alteration involves the transportation and redeposition of artifacts by wind and reservoir waters into deposits postdating inundation of the Kootenai River in 1973. A final but related problem is the lack of fine stratigraphic resolution needed to correlate and relatively date archaeological assemblages from sites throughout the project area. Lacking such fine stratigraphic resolution, all assemblages (except lower ones at 24LN1054) were "geochronologically" perceived as synchronous. In order to address these problems, two exploratory procedures were used, the glass shard analysis and the classification of sediments as analytic units.

Glass Shard Analysis

The purpose of this analysis is to discriminate between pre-Mazama and post-Mazama age deposits based on the presence or absence of Mazama (layer O) glass shards. This analysis is performed on samples removed from stratigraphic sections where neither primary nor secondary tephra layers are visible. Use of the technique, as developed by Cochran (Cochran and Leonhardy 1982; Cochran 1984), is based upon the following principles:

1. The refractive indices of Mazama volcanic glasses varies between 1.502 and 1.508 but the majority fall between 1.506 and 1.508, making them distinctive from other known sources of late Quaternary tephras. The large volume and wide geographic distribution of glass ejected 6,700 years ago coupled with the distinctive refractive index makes this tephra a useful indicator fossil for dating geologic events and correlating deposits.

2. Samples removed from a section need to be closely spaced vertically but this depends on sedimentary context and the problems being addressed.

3. A large number of grains should be counted per sample.

A limitation of the technique is that sample cleaning and counting are relatively time-consuming. Also, the distribution of glass shards in a

upper fan surfaces. The earliest human use of landscapes investigated by this project, as estimated by geologic criteria and time-diagnostic tool forms, occurred prior to deposition of the Mazama tephra layer O, 6,700 years ago. Thus, extensive human occupation may coincide with the end of the early post-glacial period of Kootenai River base level degradation, which raises the question as to what role riverine landscape evolution might play in controlling the availability of inhabitable landforms and in preserving the archaeological deposits they may contain (Hammatt 1977). In answer to this question, the following factors may have affected early human use of the Kootenai Valley environment:

1. After 11,500 but before 8,200 years ago, the Kootenai River floodplain was active and during periods of high runoff, multiple braided channels, and bar complexes formed.

2. Between periods of high runoff, temporarily abandoned floodplain surfaces supported at least sparse vegetation, which may in turn have supported animals. However, such surfaces were subject to repeated flooding and deposition, so that presumably only seasonal use of these areas by early people was likely.

3. There is evidence during this time that water tables were high, possibly related to frozen ground layers. At such times, habitation and travel on portions of floodplains may have been restricted to winter months when the ground was frozen or perhaps to the late summer or fall when river levels were lowest and floodplains well drained.

4. Geologic processes and the landforms they produce appear to have been particularly active along the interface of the main valley walls with the floodplain. Downslope sediment movement from the debris-mantled slopes and sediment influx from tributary canyons are concentrated along this interface. It is possible that habitation along this interface was less intensive than the inner valley, or that depositional processes rapidly and deeply buried the remains of such occupations.

5. Early prehistoric occupations in the project area may have focused on the inner valley portions of floodplains adjacent to the main Kootenai River channel(s). However, these landforms have been removed by successive downcutting intervals of the Kootenai River and any archaeological remains they may have contained would also have been eroded.

Stratigraphic Context of Archaeological Resources

As noted earlier, archaeological remains within the project area occur in aeolian sands capping river terraces and solifluction deposits. These types of deposits lack clear depositional strata, are nearly uniform in grain size properties, and are mixed with variable amounts of

geologic processes, details of the two gradient curves cannot be interpreted readily. For example, along the west valley wall T3 shows an anomalously low gradient. Reference to Figure 7-8, however, shows that along this wall T3 is represented by relatively few remnants scattered along only a 10 mile segment of the valley. Similarily, the variability in gradients between T6 and T4 is due partially to poor preservation. Figure 7-9 is most meaningful as a general record of late-glacial river trends. Based upon studies by Schumm (1977), Baker has suggested a mechanism of terrace formation (1983:119):

> The removal of large quantities of stored outwash and alluvium from the upper reaches of valleys could easily produce a complex response leading to multiple terracing downstream. The thick glacial fills that developed in the mountains of the western United States (Alden 1953; Howard 1960) may have led to such events. Unusually large floods may have served as the critical factor by exceeding the thresholds necessary to induce episodic erosion.

The Kootenai River generally fits this pattern, beginning sometime before 11,500 years ago, when proglacial conditions during deglaciation resulted in ponding and impeded drainage caused by stagnated ice masses and drift deposits, so that kame and outwash terraces maintained low gradients ranging between 0 and 1 foot per mile (Figure 7-9). Maximum proglacial sediment influx into the Kootenai Valley about 11,500 years ago resulted in deposition of glaciolacustrine silts and clays into Glacial Lake Kootenai (Alden 1953). This lake may have been dammed by ice or drift of the Purcell Trench Lobe to the west (Boettcher and Wilke 1978:7). Numerous kettles and pitted outwash surfaces on T8 and lower terraces in the Kootenai Valley (Clague 1975b:602) attest to the deglacial environment. Sometime after 11,500 years ago degradation of the Kootenai River channel resulted in a steepening river gradient as measured by successively lower floodplain profiles (Figure 7-9). Sometime before 8,200 years ago the Kootenai River had attained a gradient of between 3.4 and 3.6 feet per mile. This agrees well with the modern (prereservoir) Kootenai River gradient of 3.65 feet per mile as computed from US Geological Survey 7.5 minute series maps and Army Corps of Engineers documents for River Miles 219 (Libby Dam) to 271 (International Boundary). Therefore, it appears that the Kootenai River had degraded to an early-Holocene base level that remained more or less stable up to the present time.

Of more than 50 archaeological sites examined in a subsurface context and the numerous other localities where sections were measured, not a single instance of archaeological remains in water-laid sediments was observed. In the numerous localities where Kootenai River deposits were observed, single or multiple burned surfaces or buried soil horizons were recorded, indicating at least ephemerally stable surfaces between sucessive depositional episodes. Despite all efforts to obtain evidence of human occupation on these buried floodplain surfaces, it appears that widespread human utilization of this alluvial landscape occurred after complete abandonment of the floodplains by the Kootenai River and during later periods of aeolian and solifluction deposition on

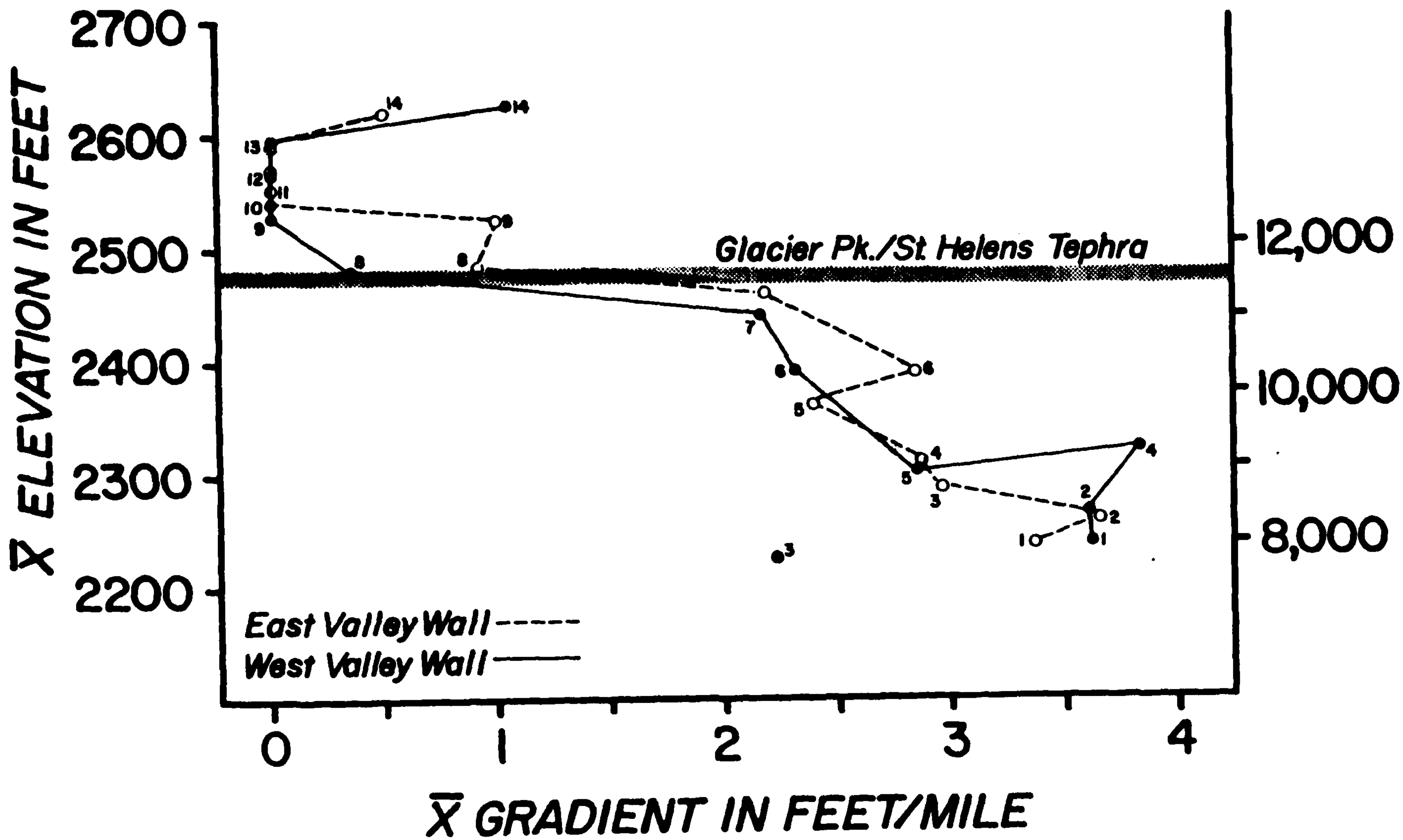


Figure 7-9. Diagram showing the gradient of Kootenai River valley terraces discussed in the text, plotted against radiocarbon years and mean terrace elevation.

Paraglacial Fan Deposits

Figure 7-8 shows a number of bench-like forms in the southern one-third of the project area, which have not been assigned terrace numbers. These paraglacial alluvial fans (following Ryder 1971) are found at elevations above T8 and occur outside of the reservoir drawndown zone in most instances. Such landforms exhibit a wide range of sedimentological and morphological properties and their formation and position on the landscape is best understood as a result of geologic processes operating along an elevational gradient. The proximal ends are found at the bases of tributary canyon slopes upstream of the tributary mouths. The distal ends occur against the Kootenai River valley and the mouths of its major tributaries. Proximally, unsorted deposits of till and colluvium thinly veneer steeper slopes, and at lower elevations thicken into tributary valley fills. As the Kootenai River valley is approached along this gradient, the relative importance of liquefaction as a determinant of depositional environment increases at the expense of gravitation. Distally, sorting increases and mean grain size decreases as the till moves downslope as colluvium, debris flows, and solifluction lobes and becomes reworked by streams into alluvial fans and deltas. Processes along this elevational gradient are not necessarily contemporaneous, so that at some tributary mouths three or more fan building episodes are apparent, representing reworking of poorly sorted, nonstratified deposits into better sorted and stratified deposits, to form multilevel fans (Ryder 1971:297).

With these relationships in mind, the unnumbered terraces depicted in Figure 7-8 consist of benchlike deposits of unsorted debris choking the mouths of tributary canyons. The surfaces of these relatively flat expanses are generally hummocky and occasionally are pitted with kettle depressions and incised by abandoned stream channels. In this respect they exhibit similar surface morphology to morainal deposits adjacent to T9-T14 in the northern portion of the study area, and some of these unnumbered benches may correlate with T9-T14. However, the major differences are that the unnumbered terraces lack stratification and gravels exhibit numerous striae, whereas in T9-T14 most deposits are well-stratified with nonstriated clasts. Finally, most such paraglacial fans occur only along the peripheries of the project area, so that these landforms have not received the same intensity of examination as other portions of the project area.

Discussion

In concluding this discussion of Kootenai River Valley terraces, emphasis is placed on the dynamic nature of landform changes and their relationship to cultural resources within the project area. It begins by referring to Figure 7-9, which shows the radiocarbon age of Kootenai River valley terraces plotted against mean elevation and mean gradient in feet per mile. The latter was computed from Figure 7-8 by dividing the change in elevation for each terrace by the length of the recorded terrace profile. Due to the poor preservation of some terraces along the valley walls and to the masking effects of mass wasting and related

As a result of repeated lateral migrations of the Kootenai River channel and preservation of only discontinuous floodplain segments, many more terrace remnants are shown in Figure 7-8 than can be reliably correlated. Therefore, with the exception of T1, solid lines in Figure 7-8 should be considered graphic means representing the dominant slope of a set of terrace remnants. As can be seen, the overall trends in slope are matched for both sides of the river.

Kame, Lake, and Outwash Terraces

Terraces 8 through 14 in Figure 7-8 are composed of stratified glaciolacustrine and glaciofluvial deposits that predate the 11,800 B.P. age of St. Helen's J tephra. As noted earlier, T8 is composed of stratified sands and gravels which are capped by thin aeolian sheet sands. In places the T8 surface has been channalized by stream action and pitted with occasional kettle depressions. Low gradient, sediment laden streams built Terrace 8 through alluvial fan deposition proximally that graded distally into deltaic deposits of Glacial Lake Kootenai.

North of Big and Sutton creeks, kame and outwash terraces 9-14 form conspicuous erosion cut bluffs along both sides of the reservoir. Along fresh erosional scars is exposed a complex sequence of well-stratified glaciofluvial outwash sands and gravels interbedded with glaciolacustrine silts and clays. At various localities this entire stratified sequence overlies till while the uppermost stratified gravels within the sequence grade laterally into flow till and till. At the mouth of Big Creek (Locality 18), a 10-30 m thick section of these stratified outwash deposits unconformably overlies well-stratified fluvial sands (Figure 7-6). A charcoal sample collected from a thin organic lens within these fluvial sands dated to 23,550±1,400 B.P. (Beta-4990) which corresponds to the Olympia Interglaciation (Fulton 1968, 1971; Clague 1975b). If, during the subsequent Fraser Glaciation, the Kootenai River valley in the project area was overridden by the Cordilleran ice sheet then the event is not recorded by the presence of a till unit at the mouth of Big Creek. Instead, the entire stratigraphic section of post-Olympia Interglacial sediments records episodes of outwash deposition involving extensive deformation of underlying stratified sediments, channel cutting, and subsequent filling of channels with coarse gravels emanating from the Big Creek drainage. North of Big Creek, these gravels may grade into ice contact glaciofluvial and glaciolacustrine deposits (Qog, Appendix G), but this relationship is not certain. Thick deposits of laminated silts and clays record the existence of an ephemeral, moraine dammed lake between the International Boundary and Pinkham Creek. The associated morainal deposits are characterized by kettle and kame topography, with numerous larger kettles permanently filled with water as in the Sophie Lake vicinity. Widespread outwash sands and gravels cap the earlier lacustrine deposits. In summary, kame and outwash terraces 9-14 were deposited in a deglacial environment, initially through accretion of ice and moraine-contact lake and stream sediments, and later as outwash and lake sediments downstream of wasting ice masses.

excavated from below the modern floodplains, at or near the modern river levels. This situation appears to contrast with the evidence presented for the Kootenai River valley within the project area. Figure 7-9 indicates that between 11,000 and 10,000 years ago, the Kootenai River's active floodplain was between 150 and 200 vertical feet above the modern river level. Two significant implications are derived from this comparison: (1) that late-glacial adjustments in the upper Kootenai River drainage system were nonsynchronous with such adjustments in the lower Snake River drainage, so that simple, direct correspondences in alluvial chronologies between these regions may not be warranted; and (2) that riverine landscape evolution accompanying Kootenai River downcutting may have presented a more geologically active landscape, in terms of frequency of erosional and depositional events, to early human inhabitants as compared with the contemporaneous riverine setting along the lower Snake River.

The idea that early-Holocene human utilization of the immediate-riverine Kootenai River landscape presented different problems than for the lower Snake River seems to be supported by the archaeological record. Throughout the middle Kootenai River valley there is little direct evidence (e.g., C-14 dates) for occupation prior to the deposition of Mazama ash (6,700 B.P.), but there is indirect evidence, mainly in the form of early projectile point style and stratigraphic positions of cultural materials, for pre-Mazama occupation (Taylor 1973; Rice 1979; Choquette and Holstine 1980; Roll 1982; Thoms et al. 1984). Fortunately, archaeologists who have worked in the region recognize the importance of erosion-deposition cycles and other geologic processes as potential variables constraining the distribution of preserved early archaeological sites.

In conclusion, geologic data from this project support the idea that during the early Holocene, the post-glacial adjustments in Kootenai River stream dynamics created an active riverine landscape in which bar complexes and braiding channels were periodically renewed until downcutting had abandoned the floodplains. Evidence for human use of this fluvial landscape is lacking, even where old stabilized land surfaces are recognized by the presence of buried soil horizons. Instead, cultural remains are confined to the post-fluvial aeolian and alluvial fan caps deposited after floodplain abandonment by the river. Future archaeological studies of early Holocene occupations in the intermontane Northwest need to recognize the important differences in climatic and geologic controls to the fluvial systems of separate drainage basins, especially in light of new evidence for the brief resurgence of alpine glacial systems during the late-Pleistocene and early-Holocene (Luckman and Osborn 1979; Beget 1981; Waitt et al. 1982; and others cited in Burke and Birkeland 1983) and the implications these hold for continued fluvial adjustments affecting river marginal landforms, economically important resources, and archaeological site preservation (Mierendorf 1984).

A final comment concerns the geologic record exposed annually during the winter/spring drawdown. On the one hand, this record is probably not unique in that a number of north-south flowing streams

within the upper Columbia drainage have similar late-Pleistocene and Holocene histories. On the other hand, the Libby Reservoir segment is the only one wherein late-Quaternary landforms and stratigraphic sections are made visible in a continuous stretch of devegetated landscape. From this viewpoint, the exposed geologic record is an important resource that has and will continue to contribute significant information to knowledge about Quaternary vegetation history, climatic change, and volcanic ash studies in the Northwest. Information presented here is but an introduction to this significant geologic record. However, the value of this chapter should be judged, in part, by its ability of Quaternary reservations to its ability to draw the attention of Quaternary researchers to the important data base preserved in the drawdown zone of Libby Reservoir.

CHAPTER 8

LITHIC ARTIFACTS, FORM AND FUNCTION

by
Alston V. Thoms

An analysis of lithic artifacts is necessary for understanding land use patterns because these artifacts represent a means of subsisting in the montane ecosystem and subsistence patterns are an integral part of site location patterns. The contract required a variety of lithic analyses including those to establish a chronology and artifact distributions, as well as functional, technological, and stylistic characteristics. The contract also stipulated that the analyses be approached using systems employed by Montana State University for the Libby Additional Units and Reregulating Dam (LAURD) project (Roll and Smith 1982), insofar as they apply to the present study (US Government 1981a:4).

In terms of the research design, lithic analyses are directed toward quantifying the lithic assemblage variability among the sites. Once the variability is quantified, sites with similar ranges and relative frequencies of artifacts can be grouped. Given some general assumptions about the likely uses to which various kinds of artifacts were put, it is reasonable to infer site function, at least in terms of broad site types. This assumes that one knows which artifacts at a given site are associated temporally and obviously this is a major assumption (Binford 1982). Even so, it is one made here, if only for purposes of developing hypotheses to be tested later. Since different food resources probably were exploited at different seasons of the year, it can be assumed that lithic artifacts, especially tools, can provide information about seasonality. Combining assemblage data derived from goal oriented lithic analyses with site locational data permits assessment of the postulated relationship between resource distributional structure and geographic variation in a land use system. Lithic artifacts, primarily projectile points, also provide information on chronological affiliation of sites and/or particular lithic assemblages. Utilization of chronological data in conjunction with artifact assemblage and site placement information allows one to detect changes in land use patterns.

Two broad kinds of lithic analyses--morphological/technological and technological/functional--were undertaken for this study. The morphological/technological analysis served to classify artifacts and to facilitate comparisons with information available from other areas. The technological/functional analysis yielded the basic site classification scheme and provided an opportunity to examine some aspects of site function. Both kinds of analyses are discussed below. The general results are summarized in tables and various illustrations in the text. Artifact descriptions as well as metric, material type, and provenience data are presented in Appendix D.

Morphological/Technological Analysis

The immediate objective of the morphological/technological analysis is to generate information concerning the overall shape of artifacts and the manner in which they acquired that shape. Stated differently, the objective is to define and describe artifacts according to their basic morphological and technological characteristics. The resulting information is utilized by grouping artifacts with similar characteristics. This step constitutes the development of a classification scheme which provides a means of quantifying and qualifying some of the variation among artifacts. In this manner, comparisons are facilitated among artifact assemblages at sites within the project area as well as with sites located elsewhere. This analysis and the resulting classification scheme are but preliminary undertakings that are subject to modification. The overall approach is quite traditional; it is hierarchical in nature and employs a widely used terminology.

The hierarchical classification scheme (Figure 8-1) encompasses all the lithic materials in the collection. Lithic artifacts as a group, are subdivided first on the basis of the manner in which they have been modified from their natural state. Four kinds of modifications are recognized and each can be considered a kind of cultural transformation (Schiffer 1972). All of the lithic artifacts were removed by people from their natural setting to a location close to where they were collected and/or recorded by archaeologists. Artifacts in one subgroup--unaltered lithics--were subjected to translocation but not to readily apparent alterations of their natural states. These kinds of artifacts traditionally are termed manuports and more recently, site furniture (Binford 1978), because they are thought to have served various purposes that did not require altering their natural morphology (e.g., table tops or hard working surfaces, seats, weights to hold down belongings or the tops and sides of habitation structures, etc.).

All other lithic artifacts were altered in at least one of three ways; by flaking, by nonflaking (i.e., grinding or battering), or by fire-cracking. Fire-cracked lithics (e.g., hearth stones or boiling stones) and unaltered lithics were not subdivided further for purposes of the morphological/technological analysis. Flaked lithics were subdivided into two categories: (1) debitage or the byproducts of tool manufacturing; and (2) formed tools or the products of the manufacturing process. Nonflaked lithic artifacts were all considered to be tools. Byproducts also are generated through the manufacture of nonflaked lithic tools (e.g., hammers, anvils, mauls, and shaft abraders), but these are probably small, amorphous pieces of rock that were detached from the tool during the manufacturing process. The resulting debitage might resemble grus or other natural clasts. However, because the research design does not address issues readily related to nonflaked lithic byproducts, they are not classified in this analysis.

Each category of lithic artifacts was subdivided to form subcategories, most of which were then subdivided into classes, which

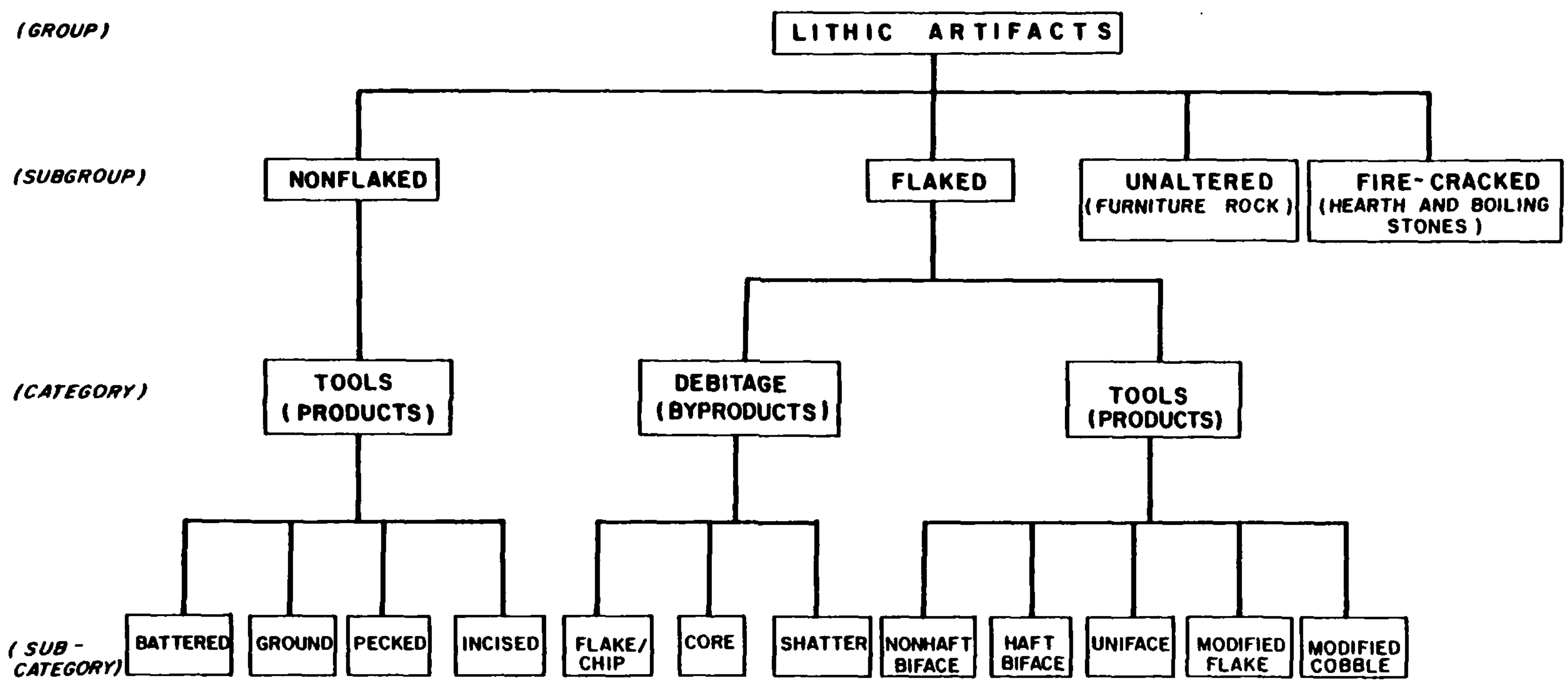


Figure 8-1. Hierarchical classification scheme for lithic artifacts in the morphological/technological analysis.

again were subdivided to form subclasses. Operationalization of the hierarchical classification scheme yielded 72 classes and subclasses of lithic artifacts which encompass the 32,201 flaked and nonflaked lithic artifacts recovered from 117 of the 249 recorded sites and isolated artifact locations.

Information derived from the morphological/technological analysis could be used in a wide variety of ways, but for purposes of this study three lines of inquiry are pursued with the objective of characterizing the overall lithic assemblage in such a way as to facilitate comparisons with the results of related investigations. The lines of inquiry are as follows: (1) establishing the general nature of and variability in the lithic tools and debitage so that inferences can be made regarding the kinds of subsistence activities that took place on landforms well above the modern floodplain of the Kootenai River; (2) utilizing the projectile point classification as the foundation for a relative chronology of sites and/or assemblages with the goal of assessing changes through time in land use patterns; and (3) monitoring the relative frequencies of lithic raw material utilization and the variation among different kinds of lithic artifacts as a means to address the question regarding changes in home range sizes and secondarily to promote a better understanding of raw material acquisition and its differential use.

Results of the lithic classification scheme are presented in the following paragraphs according to artifact categories and subcategories. Raw material types and their distribution among kinds of artifacts are discussed next. The final part of the morphological/ technological analysis section deals with a discussion of the results of the analysis and comparison with other investigations. Summary tables and artifact illustrations are presented in the text while the more detailed artifact descriptions, including provenience, metric and nonmetric data for individual artifacts, are included in Appendix D. Artifacts illustrated in Figures 8-2 through 8-21 can be found in Appendix D by referring first to the appropriate category or subcategory table in the appendix and then to the individual artifact catalog number. Tables in Appendix D are ordered in the same fashion as are the discussions of the various artifact categories and subcategories.

Flaked Lithic Debitage

Items in this category are considered, in the technological sense, to be byproducts of the manufacture of flaked stone tools. However, some of the items categorized as debitage would be classed functionally as tools if a detailed (e.g., microscopic) edge analysis was conducted. Still others, such as some items that technologically are placed in the core subcategory, are classified as tools in the technological/-functional analysis because macroscopically they exhibit apparent use wear along one or more edges. One of the biface subcategories provides another example of the dual role that individual artifacts play in the lithic analyses. Large, thick, flaked stone artifacts that technologically belong to the Biface I class are classed as cores (i.e.,

debitage) in the technological/functional analysis because they fail to exhibit macroscopically apparent edge damage. These artifacts appear to be more representative of a pretool phase (i.e., a blank produced early in the manufacturing process) or debitage phase (i.e., the detached flakes and not the Biface I itself were designed to be used as tools) than they are of tools. The distinction between artifacts used as tools to perform subsistence related tasks and unfinished artifacts, not necessarily related to those subsistence activities, is obviously an important one when dealing with land use patterns.

A total of 30,908 artifacts are encompassed by the flaked lithic debitage category which includes three subcategories; flakes/chips, cores, and shatter. Together these items represent approximately 96.0 percent of the flaked lithic subgroup. Each subcategory of debitage is discussed briefly.

<u>Flakes/Chips</u> (N=29,156)

Flakes and chips are pieces of stone that were removed from larger pieces of stone by the application of force (Crabtree 1972:64). Though technologically similar, flakes are distinguished from chips by definition. Flakes retain evidence of the striking platform and/or bulb of force (i.e., the proximal end of the artifact). Chips are broken flakes that lack their proximal ends (Thoms and Montgomery 1981:104, 112; Singleton 1982:I.69). For purposes of the present analysis, both kinds of debitage were included in one subcategory (flake/chip) that represents 94.3 percent of the flaked lithic debitage category.

Analysis of flakes and chips was limited to assigning individual specimens to one of four subclasses, based on material type and/or size. Definitions for and discussions of material types are presented in the next subsection. Of the 29,156 items in the flake/chip subcategory, 18,519 (63.5% of the flake/chip subcategory) are made from a wide variety of mudstone, 6,825 (23.4%) from several kinds of quartzite, 2,551 (8.8%) from various kinds of chert. The remaining 1,261 (4.3%) flakes and chips are in the other/small subclass. Almost all of those are very small (i.e., less than 0.5 cm in maximum dimension) pieces of debitage recovered from fine-screened sediment. Less than 20 percent of them are made from obsidian, other glassy materials and unusual kinds of rock.

<u>Shatter</u> (N=1,567)

Shatter, as a subcategory of flaked lithic debitage, is a blocky chunk of flaked lithic material that exhibits flake scars. Although considered to be a byproduct of the manufacture of flaked tools, shatter fails to exhibit negative or positive bulbs of force or other characteristics of cores and flakes/chips that facilitate determination of how and from what direction flakes were detached. Lithic raw materials with platy structure and/or flaws in an otherwise consistent mass, characteristically yield considerable quantities of shatter when

subjected to reduction by flaking (Mierendorf et al. 1982). The various mudstones and much of the quartzite available in the project area are the kinds of materials expected to yield considerable amounts of shatter.

The 1,567 identified pieces of shatter account for approximately 5.1 percent of the flaked lithic debitage category. For purposes of this analysis shatter was not subdivided beyond the subcategory level. In the technological/functional analysis, shatter was grouped with flakes and chips in a fashion similar to that used for the LAURD Project (Singleton 1982).

Cores (N=185)

This subcategory includes pieces of material used as a nucleus from which flakes were removed. Any available striking platform can be used to remove a flake; thus, flake scars can run in all directions. The detached flakes can be used in unmodified form to perform a variety of tasks or they can be modified by flaking and made into formed tools such as bifaces, unifaces, and edge modified flakes. Almost all of the cores, in the collection appear to be made from naturally occurring stream cobbles, as opposed to being extracted from bedrock outcrops. In a broad sense, cores in this collection can be characterized as generalized block cores that are rather irregular in shape. More regular or specialized and readily recognizable cores such as microblade cores, polyhedral cores, or Levallois cores (Crabtree 1972), are not represented in the collection. In this analysis, large thick bifaces that might otherwise be classified as bifacial cores are excluded from the core subcategory by definition. All bifacially flaked artifacts are included in one of the biface subcategories or classes.

Cores, representing only 0.6 percent of the debitage, are divided into four classes based on the amount and position of remaining cortex and a fifth class termed bipolar. Decorticated cores retain no cortex, but almost all of them are made from materials characteristic of local stream worn cobbles. Cores classed as cobble cores exhibit cortex on at least two opposing faces. Those termed split cobble cores appear to be made on bisected cobbles and have cortex over part or all of the hemisphere. Partial cobble cores retain comparatively small amounts of cortex on nonopposing faces. Decorticated cores and the three kinds of cobble cores are divided into two subclasses--unidirectional and multidirectional--defined on the basis of the orientation of flake scars.

The various classes of cortical cores are similar to those in the LAURD collection termed discoidal cores (Singleton 1982:I.60-69). Decorticated cores include a number of the LAURD types, but the unidirectional cores are similar to the single platform cores in the LAURD collection. Some of the LAURD artifacts termed scaled places (Singleton 1982:I.51) are like artifacts classified as bipolar cores in the present study.

Summary statistics for the various classes and subclasses of cores are provided in Table 8-1. Figures 8-2 through 8-4 illustrate the various kinds of cores. The reader is referred to Appendix D for detailed definitions, descriptions, and tabular presentations of metric and material type information.

Discussion

Raw materials identical to those from which the cores are made are available readily from widespread local gravel deposits. The deposits occur both in and adjacent to the contemporary Kootenai River channel (Roll 1982), as well as on the higher terraces well removed from the river. The 185 items classified as cores were recovered from 34 sites. Whereas cores represented only 3.6 percent of the artifact classes (excluding flakes/chips/shatter) in the LAURD sample (Singleton 1982:I.2, 60-69), those classified as cores in this analysis represent 12.5 percent of the equivalent artifact classes. There also are significant differences between the two samples in the relative frequencies of raw materials for both the core and flake/chip subcategories. Specifically, cores made from chert materials constitute 23.2 percent of the cores in the LAURD collection (Singleton 1982:I.63) and only 0.5 percent of this collection. Similarly, chert raw material accounted for 65.2 percent of the debitage (i.e., flakes/chips/shatter) from the LAURD collection (Singleton 1982:I.71), but only 9.1 percent of this sample is classified as chert. As is discussed later in more detail, differences in raw material frequencies may be indications that sites on the lowest terraces (i.e., the LAURD sample) are considerably younger on the whole, in comparison to those on the higher terraces.

The fact that cores are less common in the LAURD collection also is evident when the overall core:debitage ratios (i.e., frequency of flakes/chips and shatter divided by the frequency of cores) are compared. The core:debitage ratio for the LAURD sample is 1:197 and for the present sample it is 1:166. In other words, there are more cores in relation to other kinds of debitage in higher terrace assemblages when compared to the lowest terrace assemblages. This indicates, in general, that core reduction may have been more important at sites located on higher terraces than it was at sites on the lowest terraces tested in conjunction with the LAURD project (Singleton 1982:I.73).

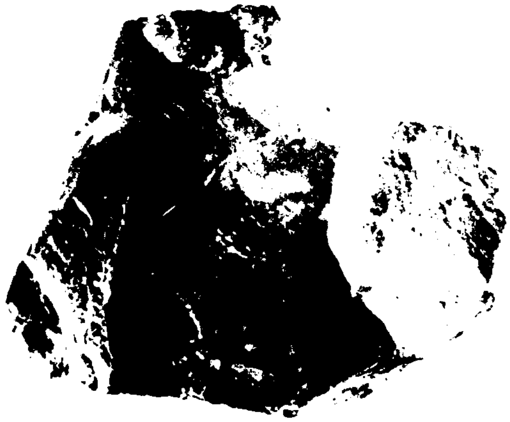
It is reasonable to infer that the purpose of core reduction is to produce flakes that are either used without further modification or are subjected to additional modification to produce formed tools. It is generally assumed that flakes, as opposed to cores, are the desired end products of core reduction in a core/flake industry. If this were not the case one would expect many or most of the cores to exhibit evidence of use as tools. This would be expected in a core/tool industry. In fact, only 50, or 27 percent, of the 185 cores (Table 8-1) exhibit enough macroscopically detected edge damage to be considered as a tool in the functional sense. This fact is not particularly surprising because almost all cores in the higher terrace assemblage are made from locally available raw materials and conservation of materials under

Table 8-1. Summary Statistics for the Core Subcategory in the Morphological/Technological Analysis.

Class	Subclass	Number of Specimens	Percent of Subcategory	No.of Sites Represented	Cores with Use Wear	
					Number	Percent
Decorticated	Multidirectional	32	17.3	14	3	9.4
	Unidirectional	9	4.9	7	5	55.6
Subtotals		(41)	(22.2)	(17)	(8)	(19.5)
Cobble	Multidirectional	26	14.1	12	9	34.6
	Unidirectional	8	4.3	8	3	37.5
Subtotals		(34)	(18.4)	(19)	(12)	(35.3)
Split Cobble	Multidirectional	3	1.6	1	2	66.7
	Unidirectional	22	11.9	9	13	59.1
Subtotals		(25)	(13.5)	(9)	(15)	(60.0)
Partial Cobble	Multidirectional	73	39.4	13	14	19.2
	Unidirectional	2	1.1	1	0	0.0
Subtotals		(75)	(40.5)	(14)	(14)	(18.7)
Bipolar	Bipolar	10	5.4	8	1	10.0
Subtotal		(10)	(5.4)	(8)	(1)	(10.0)
TOTALS		185	100.0	34	50	27.0

a (24LN388-3)

b (24LN1054-449)



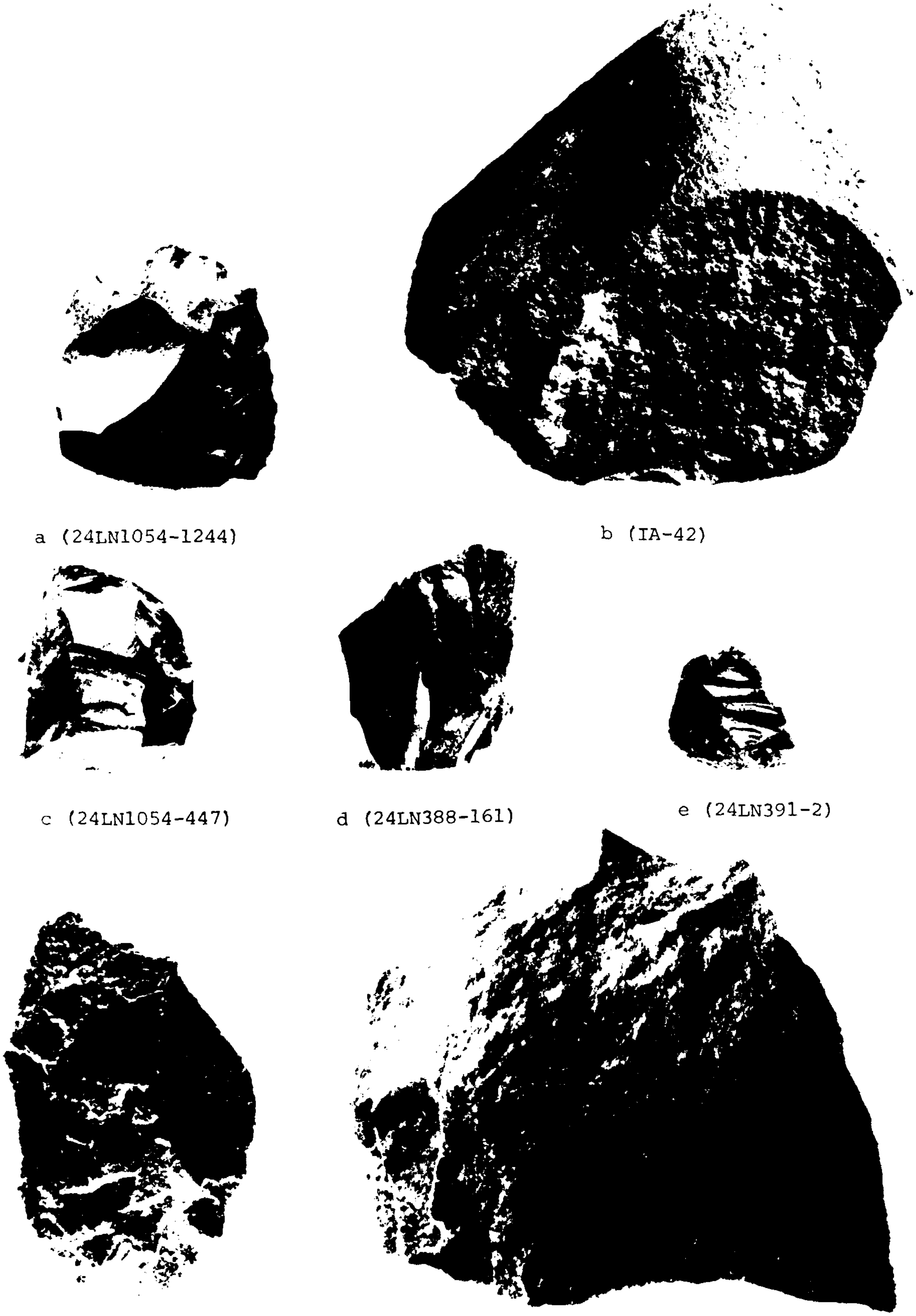
c (24LN385-117)

d (24LN1054-462)

e (24LN1054-472)

f (24LN1073-45)

Figure 8-2. Cobble cores (actual size): unidirectional a, b; multidirectional c-d; and partial cobble multidirectional core e-f.



a (24LN1054-1244)　b (IA-42)

c (24LN1054-447)　d (24LN388-161)　e (24LN391-2)

f (24LN1073I-79/S/34)　g (24LN1054-189)

Figure 8-3. Partial cobble cores (actual size): unidirectional core a-b; Bipolar cores c-e; and Decorticated unidirectional core f-g.

a (24LN364-32)

b (24LN386-80)

c (24LN388-52)

d (24LN1054-22)

e (24LN1054-1269)

f (24LN386-78)

Figure 8-4. Decorticated multidirectional core a-b; Split cobble cores: unidirectional c-d; and multidirectional e-f (artifacts actual size).

conditions of abundance would not be expected and indeed is not evident in the assemblage. Three points support this conclusion: (1) there are many cores present in the sample; (2) many of them are large and readily subject to further reduction, and (3) about 73 percent of all the cores do not seem to have been used intensively as tools.

Mention should also be made of the evidence that some of the mudstone cores may have been heat treated as a means of rendering the raw materials more flakeable (Bleed and Meier 1980). Evidence of heat treatment appears on several fine-grain mudstone cores is in the form of a dull, granular textured surface over most of the flake scars. Flakes that were removed using the dull, granular textured surface as a striking platform (i.e., presumably after heat treatment), exhibit flake scars with comparatively more glossy and vitreous surfaces. A second line of evidence comes from the "backyard experiments" conducted during the course of fieldwork. Black, fine-grain mudstone cobbles were flaked to remove most of the cortex, then placed in a "campfire" used on several occasions. Subsequently the cores were removed from the campfire and flakes were detached once more. Not only were flakes easier to detach, but the surfaces of the new flake scars were more glossy and vitreous than those removed before heat treatment. In fact, the cores heat treated in the experiment exhibited characteristics virtually identical to those in the sample that were thought to be heat treated. The "backyard experiment" was motivated by the fact that very fine grain, almost glossy mudstone, could not be found in cobble form in the local gravel deposits, yet many tools in the collection seemed to be made from such material. Thus, one objective was to produce the very fine grain, almost glossy mudstone. In that respect, the experiment probably was successful. Although it is not being argued that heat treatment was an important aspect of lithic technology in the study area, available data suggest it may have occurred and that further study is warranted. It would be of interest to establish when, if ever, heat treating was an important aspect of local lithic technology. With some chronological control it might be possible to determine the relationship between heat treatment of local raw materials and the influx of raw materials from outside the area, especially cherts. For example, would the intensive use of local raw materials for all types of tools (including thin bifaces and projectile points) at one point in time be an indication of limited access to exotic raw materials, which, at other points in time, were widely used for the manufacture of some tools such as thin bifaces and projectile points? What is the relationship between mobility or home range size on the one hand and heat treatment and trade in raw materials on the other hand?

Flaked Lithic Tools

Most of the artifacts in this category are considered to have been used as or intended for use as tools. These are the same kind of artifacts considered as tools in the LAURD collection because their edges were "retouched" (Singleton 1982). Functional edges are produced through the process of lithic reduction and the resulting edges are conducive to a variety of tasks including scraping, cutting, sawing,

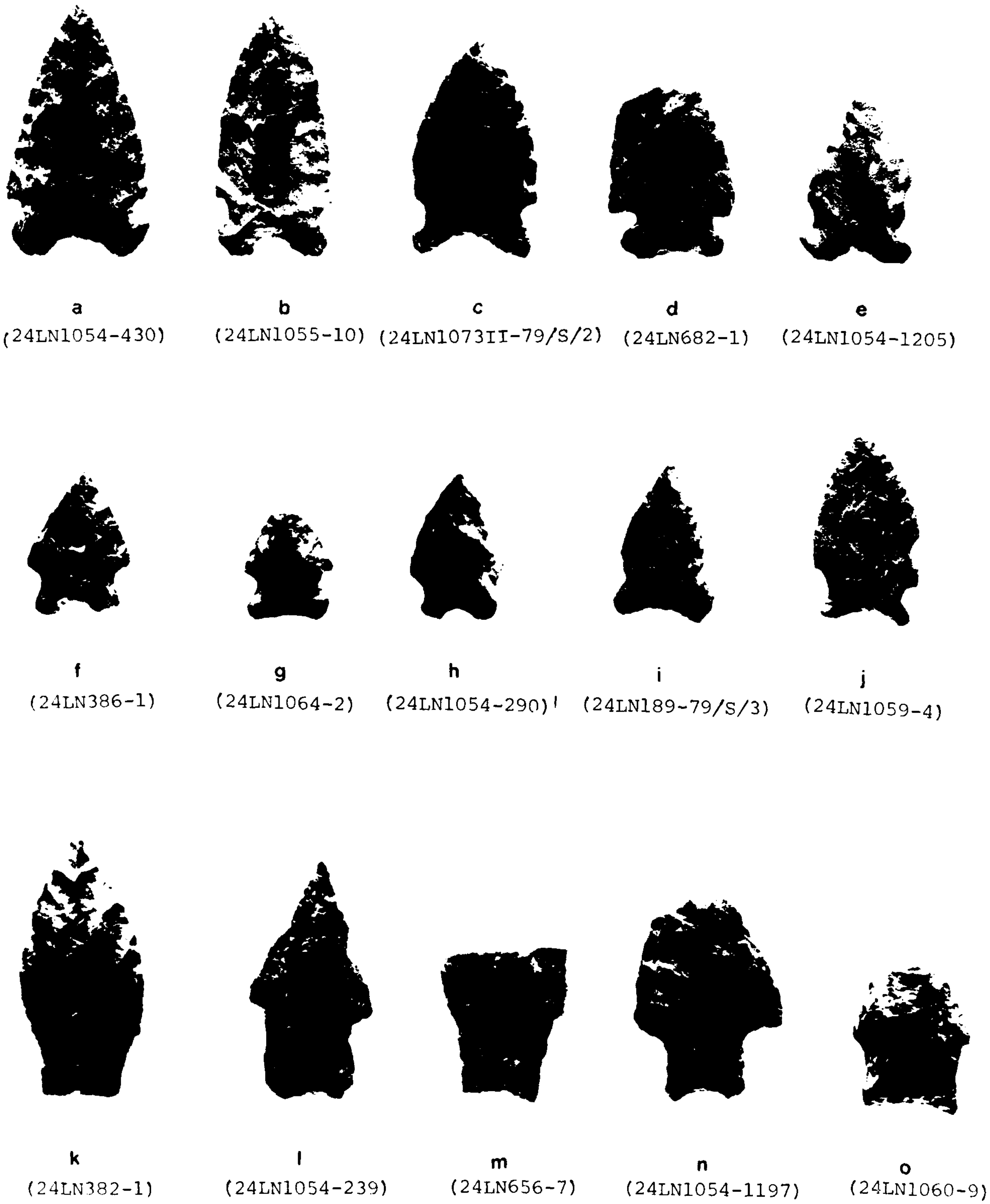
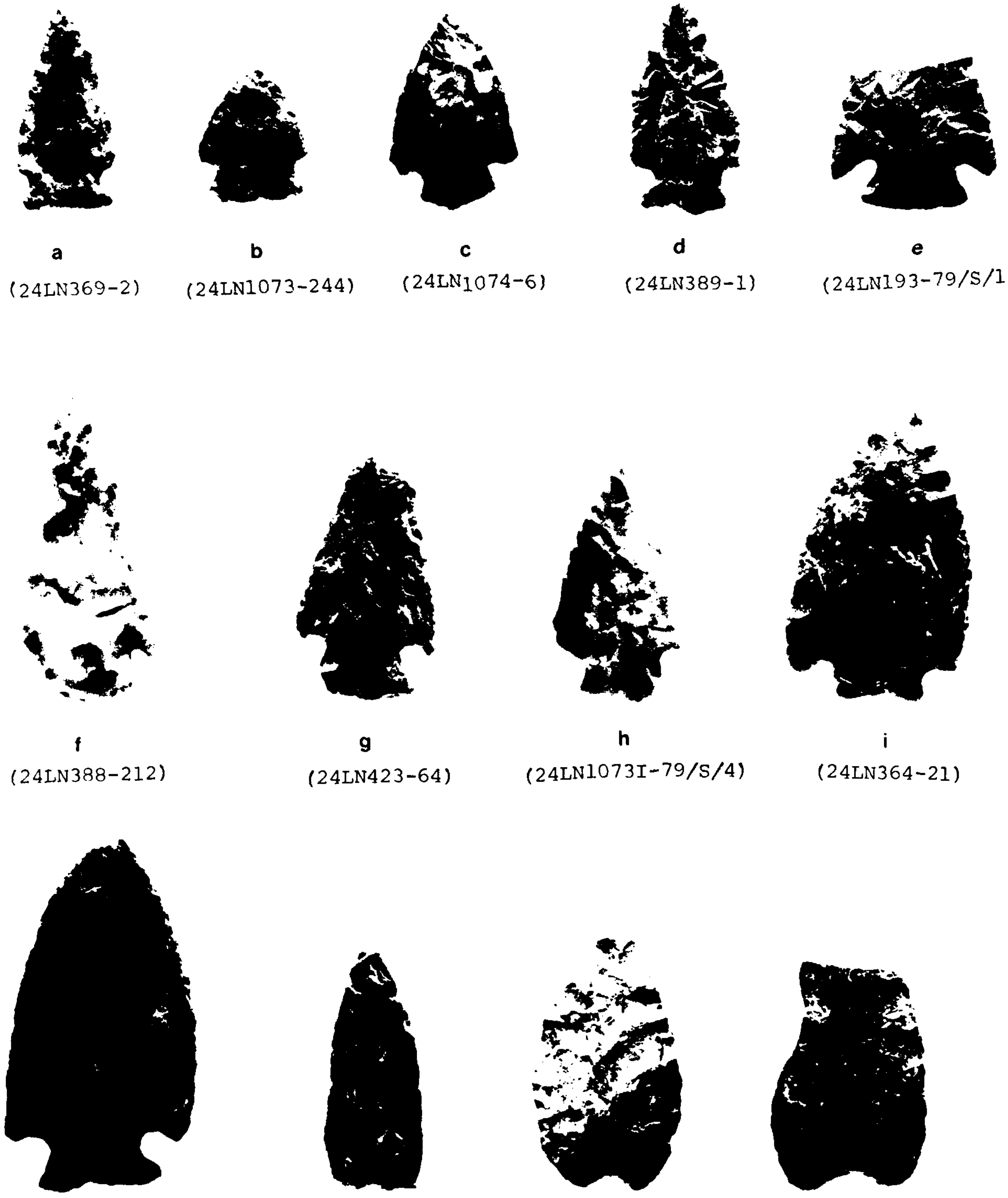


Figure 8-13. Large size projectile points (actual size): Large, "eared" indented base; subtype a a-e; subtype b f-j; Large, stemmed concave base k-o.



a (24LN369-2)
b (24LN1073-244)
c (24LN1074-6)
d (24LN389-1)
e (24LN193-79/S/1)

f (24LN388-212)
g (24LN423-64)
h (24LN1073I-79/S/4)
i (24LN364-21)

j (24LN189-79/S/2)
k (IA-19)
l (24LN1074-32)
m (24LN712-1)

Figure 8-12. Moderate size projectile points (actual size): Large, short stemmed a-b; Large, corner-notched barbed: subtype a c-h; subtype b l-j; Large, indented base k-m.

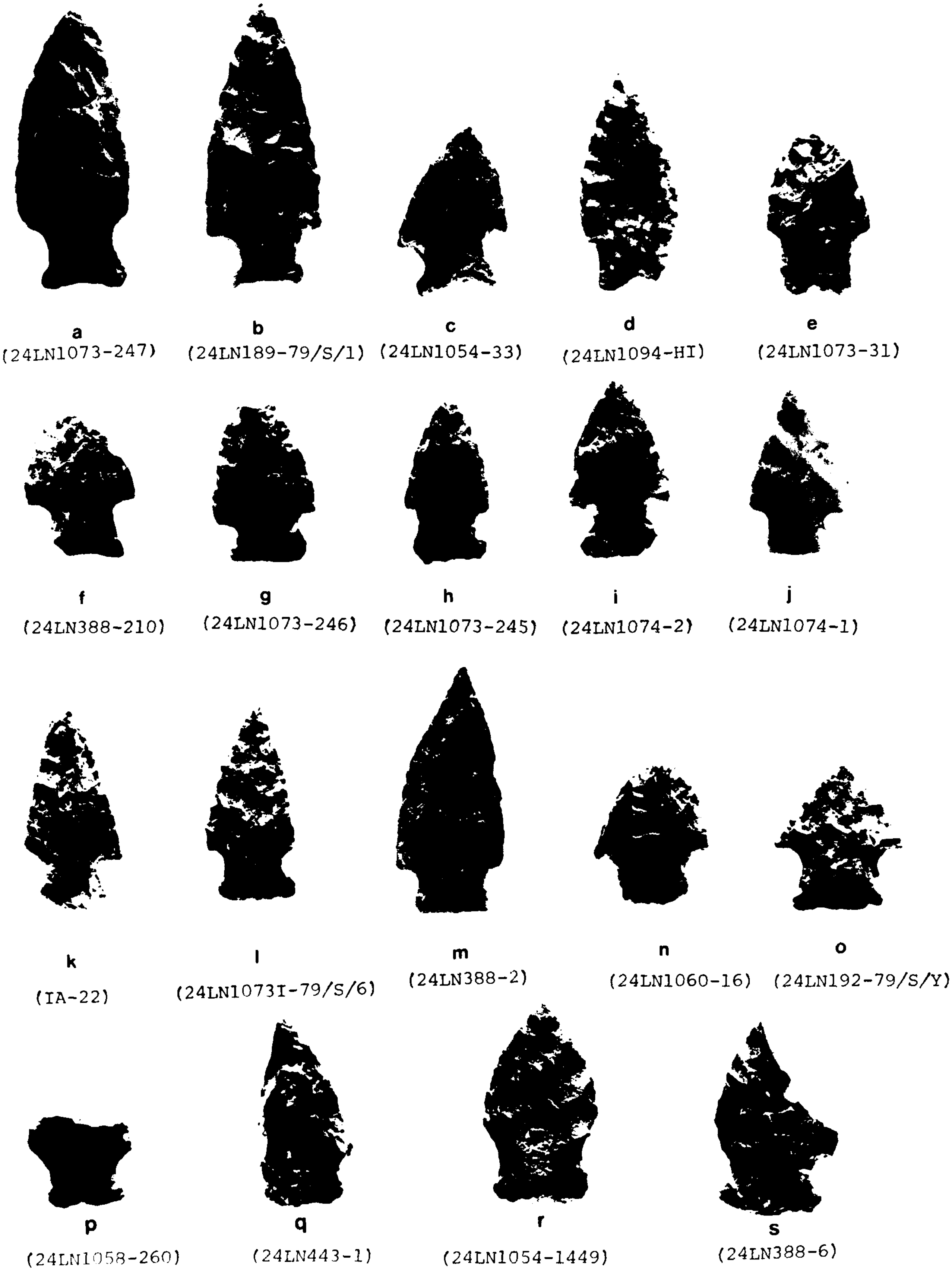


Figure 8-11. Moderate size projectile points (actual size): Medium, stemmed, concave base a-f; Medium, corner to side-notched g-l; Large, stemmed straight base m-o; Large, wide notched p-s.

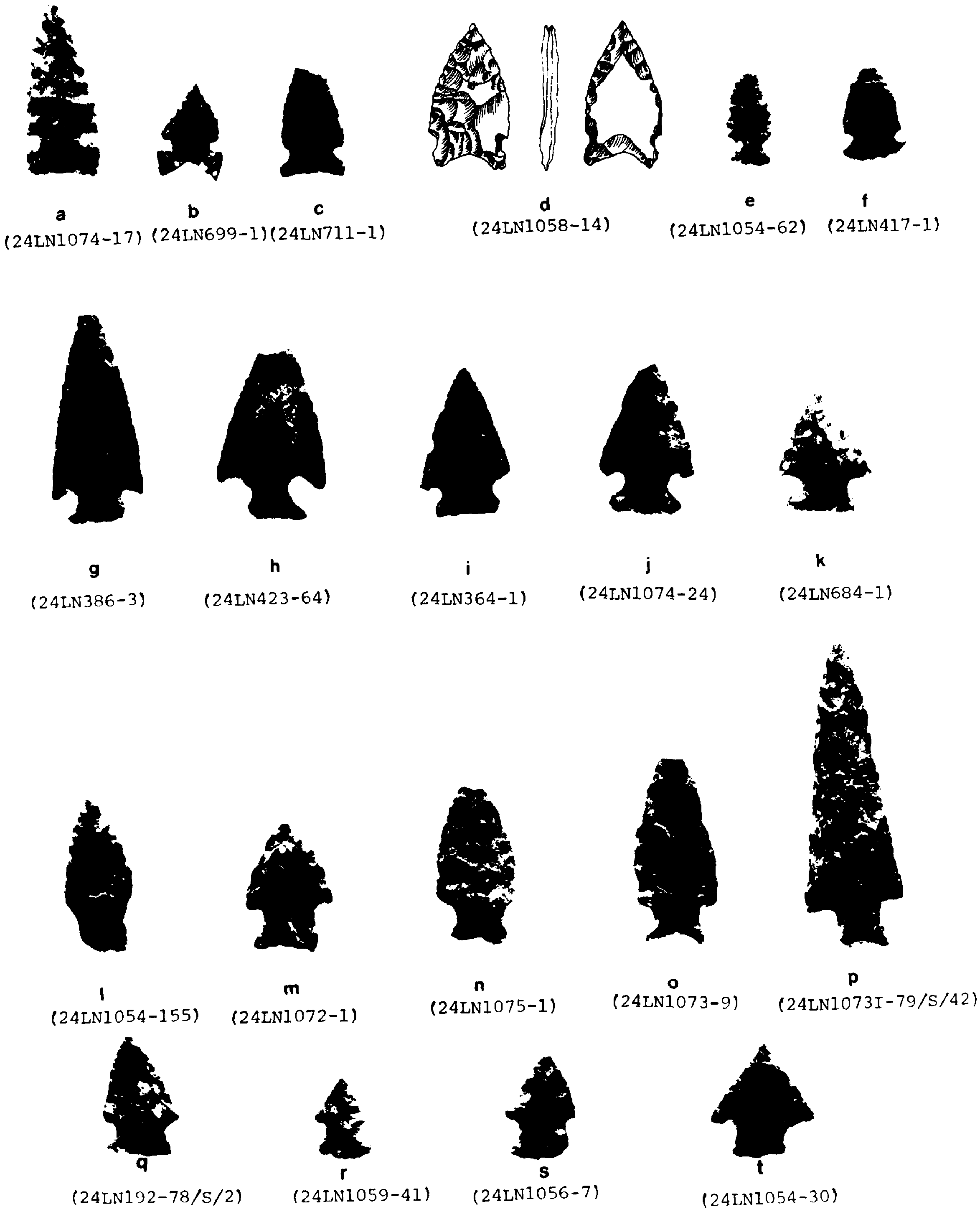


Figure 8-10. Small size projectile points (actual size): Small, side-notched: subtype a a-c; subtype b d; and subtype c e-f; Small, corner-notched barbed g-k; Small, corner notched concave base l-p; Small, corner to side-notched q-t.

Table 8-3. Summary Statistics for the Haft Biface Subcategory in the Morphological/Technological Analysis.

Class	Subclass	Number of Specimens	Percent of Subcategory	Number of Sites Represented
Small Size (Arrow Point Size)	Small (Sm.) Side-notched	12	5.4	9
	Sm.Corner-notched, Concave Base	13	5.9	7
	Sm.Corner to Side-notched	6	2.7	5
	Sm.Corner-notched,Barbed	11	5.0	8
	Sm.Size Fragment	7	3.1	6
SUBTOTAL		49	22.1	25
Undetermined Size	Haft Fragment	2	0.9	2
	Blade Fragment	5	2.2	4
SUBTOTAL		7	3.1	6
Moderate Size (Medium and Large Dart Point Size)	Large (Lg.) Corner-notched, Barbed	15	6.8	15
	Lg. Short Stemmed	5	2.3	4
	Medium (Md.) Corner to Side-notched	8	3.6	5
	Lg. Stemmed, Straight Base	4	1.8	4
	Lg. Wide-notched	8	3.6	5
	Md. Stemmed, Concave Base	7	3.1	6
	Lg. Indented Bone	6	2.7	5
	Moderate Size Haft Element	16	7.2	8
SUBTOTAL		69	31.1	32
Large Size (Large Dart Point Size)	Large (Lg.) Eared, Indented Base	27	12.2	15
	Lg. Side-notched	16	7.2	9
	Lg. Stemmed, Concave Base	6	2.7	4
	Lg. Lanceolate	9	4.0	7
SUBTOTAL		58	26.1	24
Other (Misc. Haft Bifaces and Fragments)	Very Large Notched Biface	5	2.2	5
	Large Contracting Stem	3	1.4	3
	Single Notched	4	1.8	2
	Dart Size Blade Fragments	27	12.2	18
SUBTOTAL		39	17.6	25
TOTAL		222	100.0	62

The collection of haft bifaces includes 222 specimens from 54 sites, representing 19.3 percent of the 1,149 flaked lithic tools. This subcategory is divided into a number of classes, most of which are divided into subclasses or what might be termed projectile point or knife types. Class and subclass divisions (as well as occasional divisions within subclasses) are based on overall size and shape of the artifacts. Summary statistics for the various haft biface classes and subclasses are presented in Table 8-3. Figures 8-10 through 8-15 illustrate examples of the various kinds of haft bifaces. Brief descriptions of the various classes and subclasses are presented here and detailed descriptions and metric data are provided in Appendix D.

The small or arrow point size class of haft bifaces encompasses those artifacts that tend to have minimum tang widths (i.e., the distance between notches or across the stem or between ground lateral edges) between 8.2 and 9.1 mm. Several studies (e.g., Corliss 1972; Thoms 1977; Thomas 1978) have indicated that minimum tang width measurements provide a useful means of distinguishing between arrow and dart size projectile points. Arrow size projectile points (N=49) are assigned to one of five subclasses on the basis of types of notches. Several (N=7) projectile points fall between small and moderate size haft bifaces and are thus classified as "undetermined size." Moderate size haft bifaces or dart points have minimum tang widths that range between 10.1 and 18.6 mm, but most are about 12.5 mm. These bifaces (N=69) are subdivided on the basis of size and hafting modification. Large size haft bifaces or large dart points (N=58) include two side-notched subclasses, one large stemmed subclass, and a lanceolate subclass. They have minimum tang widths that vary between 12.0 and 16.0 mm, with most being in excess of 14.0 mm. The remaining haft bifaces are placed in the "other" class (N=39) and subdivided on the basis of the shape and size of the hafting modification. Blade fragments also represent a subclass of the haft bifaces class because they are more like the blade portion of moderate and large (i.e., dart point size) size haft bifaces than any other class of artifact. However, it must be recognized that these blade fragments also resemble some of the triangular artifacts in the Biface IV class and that their assignment to the haft biface subcategory is somewhat arbitrary. The very large, notched bifaces and the large contracting stem bifaces are examples of artifact subclasses often termed hafted knives either because they seem to be too large or of the wrong shape to be called projectile points. On the other hand, the single notch subclass may well represent unfinished or assymetrical projectile points.

With the exception of the "other" class of haft bifaces, most of the subclasses are similar to one of the 11 types of projectile points defined for the LAURD collection (Roll 1982; Singleton 1982). Table 8-4 equates the projectile point types in the LAURD system with those defined for this project. It is also possible to equate the three major classes of haft bifaces with the projectile point types considered to define the various phases in the LAURD system. Roughly, the small size class contains specimens similar to those characteristic of the Yarnell and Warex phases or even more generally the Late Prehistoric Period. The moderate size projectile points are like those used to designate the

tend to range between 1.5 and 3.5 cm in thickness. They are subdivided into three classes on the basis of shape: (1) triangular; (2) ovoid to rectangular; and (3) general fragments. Biface IIs are three times as common as Biface Is. Most of the Biface I and II artifacts are similar to opposite face cores and perhaps the biface preforms in the LAURD collection (Singleton 1982), but those in this collection are substantially thicker than the "biface preforms." In fact, 19 (65.5%) of the artifacts in the Biface I class and 27 (29.3%) of those in the Biface II class either fail to exhibit evidence of flaking to "regularize" the edges or they fail to exhibit readily observable edge damage suggesting use as a tool. From a more functional standpoint these 46 artifacts, representing 50 percent of the Biface I's and II's probably would be considered cores. The remaining 50 percent is likely to represent various kinds of blanks, preforms and actual tools.

Artifacts in the Biface III class consist of bifaces less than 1.5 cm thick, with relatively straight (i.e., nonsinuous) margins, and uniform flake scars. These bifaces appear to have been reduced or thinned by percussion flaking, but have not been pressure flaked. The class probably contains both completed tools and "preforms" (i.e., artifacts that are not quite finished). Biface IIIs are subdivided into several subclasses based on shape. These artifacts are most like the unnotched bifaces (also subdivided based on shape) and biface preforms (with a mean thickness of 0.8 cm) in the LAURD collection (Singleton 1982). Biface IVs are very similar to Biface IIIs, except that the former appear to have been pressure flaked along all or part of the edges. They are most similar to the unnotched bifaces in the LAURD collection (Singleton 1982).

Nonhaft bifaces in this collection, like bifaces in the LAURD collection, occur in similar frequencies (i.e., 26.6% and 28.3% respectively), but there are important differences. One of the more obvious differences concerns the fact that a majority of the LAURD specimens are made from chert, as compared to only 4 percent of those in this collection. More is said about this later. Another apparent difference between the collections is that nonhaft bifaces thicker than 1.5 cm are at least five times more common in the higher terrace assemblage than they are in the LAURD or lowest terrace assemblage. Assuming that some of the Biface I and II artifacts are cores and that many others are tools, it is apparent that the lithic reduction systems and at least some of the subsistence activities, as inferred from the two assemblages, differed considerably.

Haft Bifaces (N=222)

The term haft bifaces includes all thin, symmetrical, bifacially flaked artifacts with obvious hafting modifications. Notches, stems, or basal element grinding represent alternative forms of hafting modification. Most haft bifaces are complete enough to be placed in classes and subclasses. Haft bifaces are equated with the various types of projectile points and some of the unnotched bifaces, including the nondiagnostic fragments in the LAURD system (Singleton 1982).

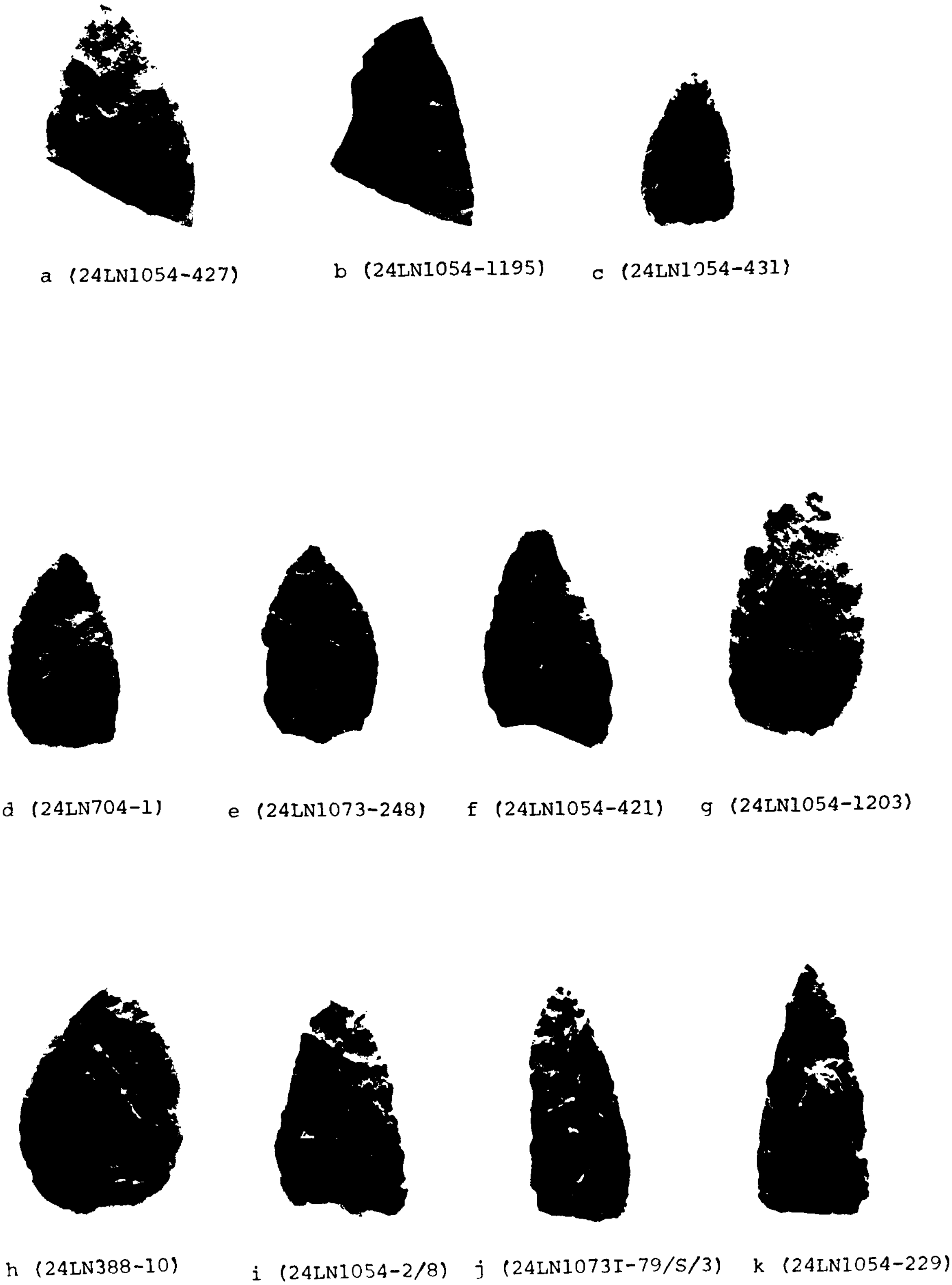


Figure 8-9. Biface IV (actual size): pointed end fragment a-b and triangular c-k.


a (24LN1054-406)


b (24LN193-1)


c (24LN1054-72)


d (24LN1058-7)


e (24LN366-1)


f (24LN1054-320)


g (24LN441-1)


h (24LN1054-1196)


i (24LN392-6)

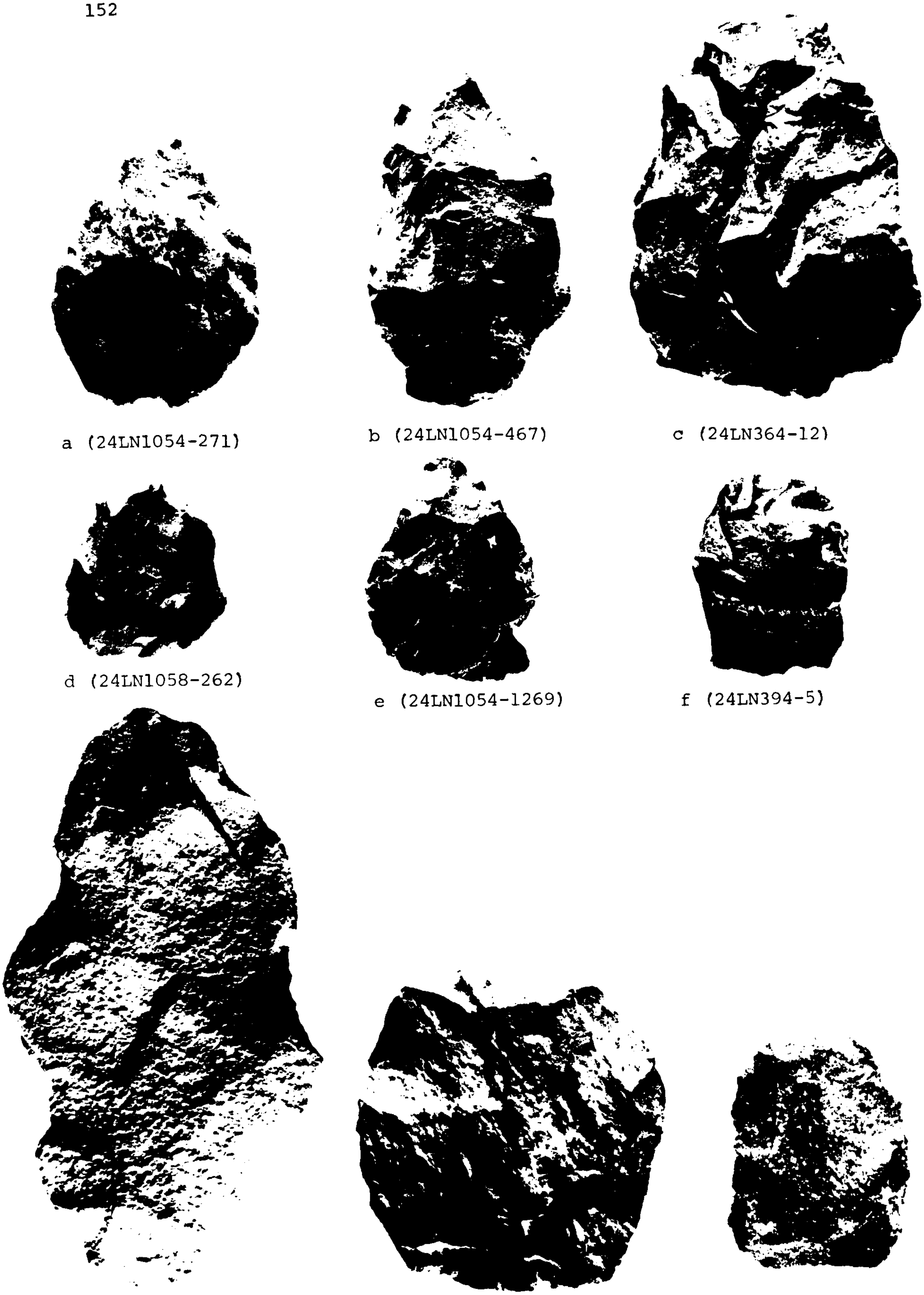

j (IA-37)

Figure 8-8. Biface III (actual size): triangular a-f; Biface IV (actual size): unnotch ovoid g-i; pointed end fragment j.

a (24LN1054-294) b (24LN1076-4) c (24LN191-79/5/3 d (24LN1056-3)

e (24LN1054-7262) f (24LN392-7) g (24LN1054-1216) h (24LN1054-311)

Figure 8-7. Biface III (actual size): lanceolate a-d and ovoid-rectangular e-h.



a (24LN1054-271)

b (24LN1054-467)

c (24LN364-12)

d (24LN1058-262)

e (24LN1054-1269)

f (24LN394-5)

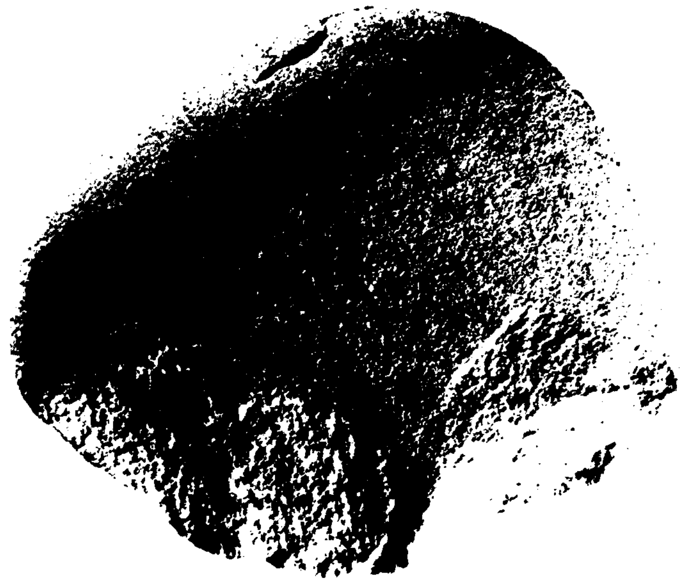
g (24LN1054-1246)

h (24LN1059-31)

i (24LN1055-2)

Figure 8-6. Biface II (actual size): triangular a-e and ovoid-rectangular f-i.

a (24LN1073-4/79/S/12)



b (24LN676-1)

c (24LN1073I-79/S/32)

d (24LN1054-1327)

Figure 8-5. Biface I (actual size): partial a-b and complete c-d.

Table 8-2. Summary Statistics for the Nonhaft Biface Subcategory in the Morphological/Technological Analysis.

Class	Subclass	Number of Specimens	Percent of Subcategory	No.of Sites Represented	Nontool Bifaces (Cores) Number	Nontool Bifaces (Cores) Percent
Biface I	Complete	22	6.8	8	15	68.2
	Partial	7	2.1	5	4	57.1
Subtotal		(29)	(8.9)	(11)	(19)	(65.5)
Biface II	Triangular	9	2.8	6	3	33.3
	Ovoid/Rectangular	32	9.8	12	12	37.5
	Fragments	51	15.7	18	12	23.5
Subtotal		(92)	(28.3)	(25)	(27)	(29.3)
Biface III	Triangular	15	4.6	6		
	Ovid/Rectangular	25	7.7	11		
	Lanceolate	4	1.2	4		
	Pointed End Frag	26	8.0	7		
	Ovoid/Rectang Frag	64	19.7	18		
	Medial Fragment	8	2.5	4		
	Undetermined Frag	24	7.4	7		
Subtotal		(166)	(51.1)	(31)		
Biface IV	Triangular	16	4.9	8		
	Ovoid	2	0.6	2		
	Pointed End Frag	9	2.8	5		
	Ovoid/Rectang Frag	7	2.2	6		
	Medial Fragment	4	1.2	1		
Subtotal		(38)	(11.7)	(15)		
Subcategory Totals		325	100.0	48	46	

drilling, etc. In some cases, such as the traditional "utilized flake," working edges are not intentionally formed by further lithic reduction; rather, the sharp edges are used without modification.

A total of 1,149 artifacts are included in the flaked lithic tool category. The category includes five subcategories, nonhaft biface, haft biface, uniface, edge modified flake/chip, and edge modified cobble. Together these items represent 3.6 percent of the flaked lithic subgroup. Each subcategory is discussed in the following subsections.

Nonhaft Bifaces (N=325)

This subcategory includes all artifacts that are flaked invasively on two faces, but that have not been obviously modified to facilitate hafting. In other words, nonhaft bifaces include all bifaces that are neither notched or stemmed nor exhibit lateral and/or basal grinding along their proximal margins. Stated differently, nonhaft bifaces include all bifaces except those routinely called projectile points and hafted knives. This subcategory includes the unnotched biface, biface preform, and perforator classes of bifaces and probably the opposite face class of cores in the LAURD system (Singleton 1982:I.3-36).

The collection of nonhaft bifaces includes 325 specimens from 43 sites in the project area. Nonhaft bifaces represent 28.3 percent of the 1,149 flaked lithic tools and the subcategory is divided into four classes, each with two or more subclasses. Definition and classification of nonhaft bifaces takes place within a general framework of a bifacial reduction system or sequence. Those specimens that are comparatively the thickest and have the most sinuous margins or edges (i.e., Biface I) represent the early stages of reduction, while those that are the thinnest and have the straightest margins (i.e., Biface IV), are indicative of the final stage of reduction. Nonhaft bifaces are distinguished from cores because on bifaces all flakes originated along the margin or edge, and generally are oriented toward the opposite margin. Cores, on the other hand, have flake scars that originate from any available platform, but generally were not detached consistently from a margin that could serve as the working edge of a tool.

Summary statistics for the various nonhaft biface classes and subclasses are presented in Table 8-2. Figures 8-5 through 8-9 illustrate examples of the various kinds of nonhaft bifaces. Brief descriptions are presented here, but for detailed descriptions and data for individual artifacts, the reader is referred to Appendix D.

The Biface I class is made up of artifacts that have a thickness of at least 2.2 cm, though 21 of the 27 specimens in this class are at least 4.0 cm thick. Edges are very sinuous and cortex is present on most specimens, indicating they tend to be made from stream worn cobbles. Two subclasses make up the Biface I class: (1) complete bifaces with flakes detached from most of the margin; and (2) partial bifaces with less than 50 percent of their margins flaked. Artifacts in the Biface II class exhibit less sinuous to almost straight edges and

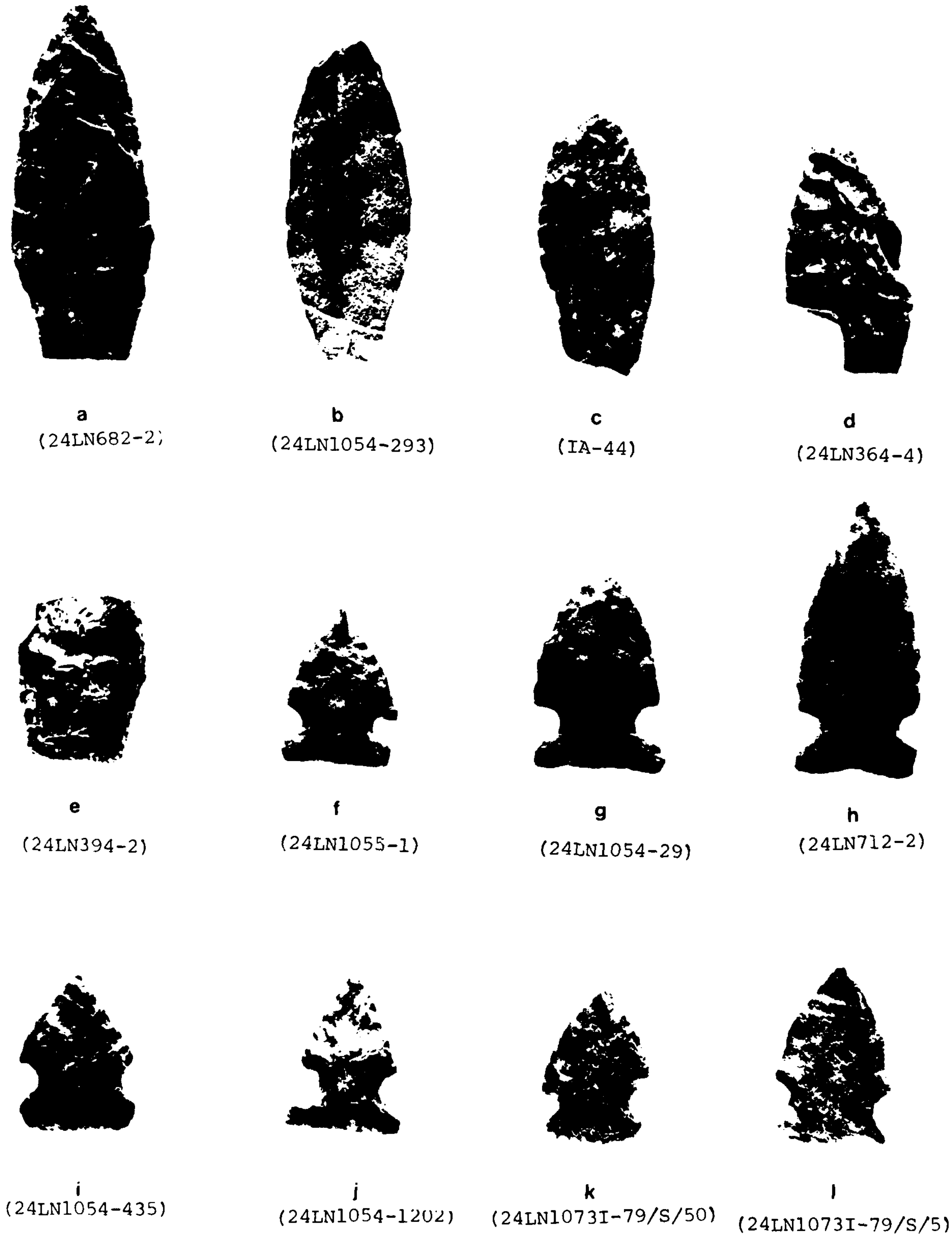


Figure 8-14. Large size projectile points (actual size): Large, lanceolate a-e; Large, side-notched: subtype a f-h; subtype b i-l.

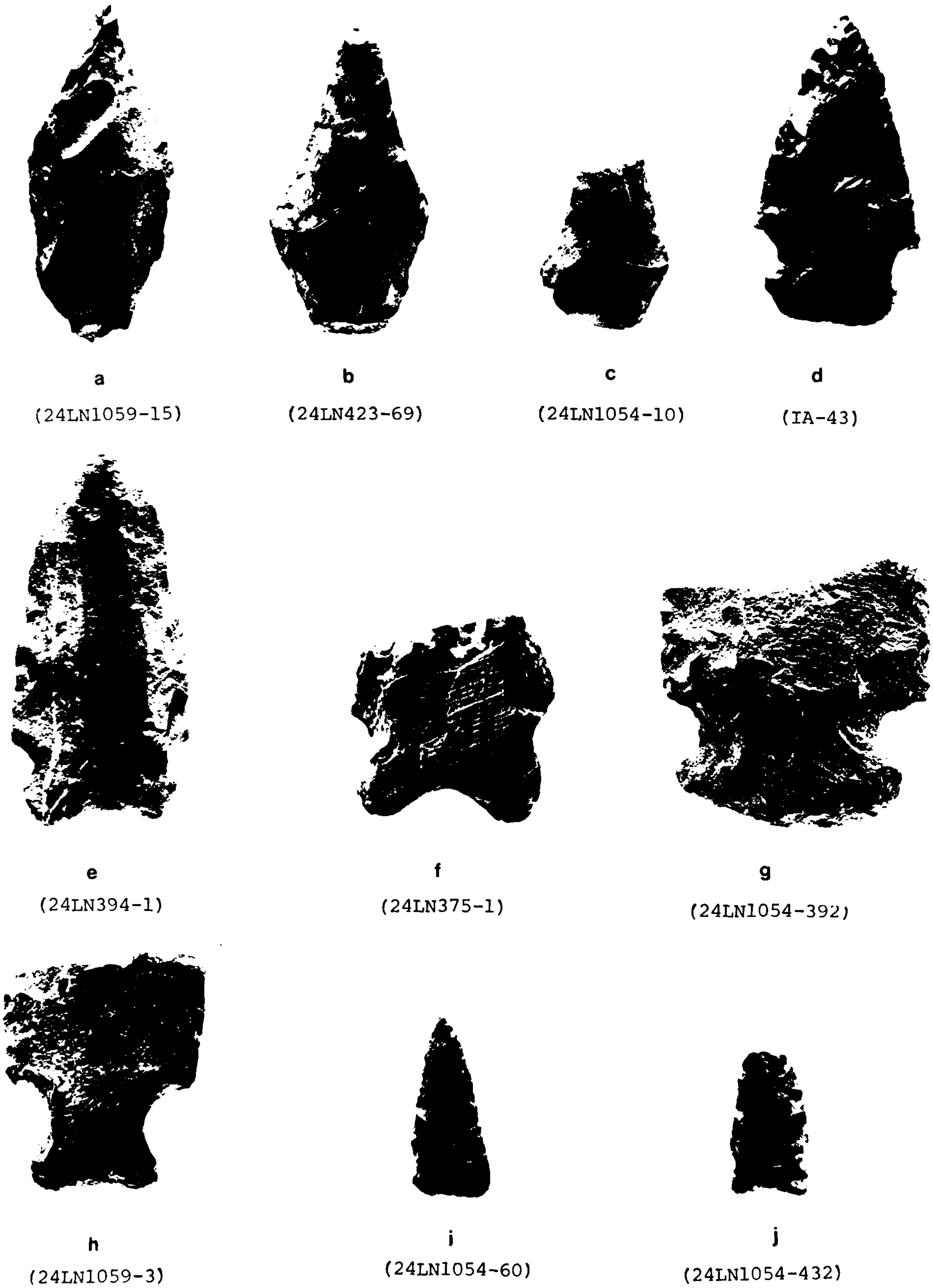


Figure 8-15. Other haft bifaces (actual size): large contracting stem a-c; very large notched d-h; single side-notched i-j.

Table 8-4. Comparison of Projectile Point Classification Schemes.

LAURD Phase Sequence	LAURD Projectile Points			Equivalent Projectile Points		
	Type	Number	Percent	Subclass	Number	Percent
Yarnell (750-80 B.P.)	1 (A&B)	90	23.2	Small, Side-notched (a, c, and fragments)	11	7.2
Warex	(2?)			Small, Corner-notched, Concave Base	13	8.5
(1250-750 B.P.)	2	34	8.8	Small, Corner to Side Notch	6	3.9
	3	62	16.0	Small, Side-notched (b)	1	0.7
Stonehill (1750-1250 B.P.)	7	74	19.0	Large, Wide-notched	8	5.2
Kavalla	(4?)			Small, Corner-notched and Barbed	11	7.2
(2950-1750 B.P.)	4	52	13.4	Large, Corner-notched and Barbed	15	9.8
	5	22	5.7	Large, Stemmed Straight Base	4	2.6
	(6?,7?)			Medium, Corner to Side-notched	8	5.2
	6	15	3.9	Large, Short Stemmed	5	3.3
Calx	8	20	5.1	Medium, Stemmed, Concave Base	7	4.6
(4450-3250 B.P.)	9	12	3.1	Large, Indented Base	6	3.9
Bristow	11	4	1.0	Large, Eared and Indented Base	27	17.6
(5450-4450 B.P.)	(7?,11?)			Large, Side-notched	16	10.5
(Early)	(10?)			Large, Stemmed, Concave Base	6	3.9
	10	3	0.8	Large, Lanceolate Shaped	9	5.9
TOTALS		388	100.0		154	100.0

Stonehill, Kavalla, and Calx phases which correspond roughly to a late Middle Prehistoric Period. Large size haft bifaces are most like those that characterize the LAURD project's Bristow Phase, which is encompassed by the more general early Middle Prehistoric and perhaps Early Prehistoric periods.

Identifiable projectile points (N=388) in the LAURD collection (Roll 1982) constitute 21.2 percent of the flaked lithic tools and the 154 items identified to projectile point subclasses in this study constitute only 13.3 percent of the collection. While it might be argued that these frequencies are somewhat similar, the subclasses and types are represented differentially. Significant differences are most apparent for the projectile points considered to represent the Late Prehistoric Period (Yarnell and Warex phases). These arrow point size artifacts represent 47.9 percent of the LAURD sample and only 20.3 percent of this, the higher terrace sample. Projectile points considered to be indicative of the late Middle Prehistoric Period (Stonehill, Kavalla, and Calx) are represented in more similar frequencies, 50.3 percent for the LAURD sample and 41.8 percent for the higher terrace sample. The most striking differences occur when comparing the frequencies of projectile points characteristic of the earlier time periods, namely the early Middle Prehistoric and Early Prehistoric periods. Projectile points thought to represent the Bristow Phase account for only 1.8 percent of the LAURD sample, yet similar artifacts constitute 37.9 percent of this sample. Considering that the LAURD collection was recovered from the lowest terraces and that the collection for this project came from higher terraces, it seems clear that differential land use patterns are in evidence at different points in time. Seemingly, the lowest terraces were utilized most intensively during the later time periods, while the higher terraces were utilized most intensively during the earlier time periods.

Uniface (N=24)

Unifaces differ from bifaces primarily because the former are flaked only on one side. Readily apparent invasive flake scars cover at least 50 percent of one face of the uniface, while the other remains largely unmodified. In fact, it is the invasiveness of the flake scars that distinguish unifaces from unifacially edge modified artifacts. However, unifaces also tend to be markedly plano-convex in cross section in comparison with most classes of edge modified flakes and chips. They are most similar to the end scrapers in the LAURD collection (Singleton 1982), but unifaces in this sample tend to be larger.

There are only 24 artifacts in the uniface subcategory. These were recovered from 10 sites and they represent only 2.1 percent of the flaked lithic tools. Unifaces are subdivided into three classes--end scraper, large, and fragments--based largely on shape and flake scar attributes (Table 8-5 and Figure 8-16). End scrapers (N=10) tend to be comparatively small in size (ca. 3.5 x 2.7 x 1.0 cm) and subtriangular in shape. Most appear to have been pressure flaked along the margin of the bit or working end. Alternatively, large unifaces (N=12) exhibit

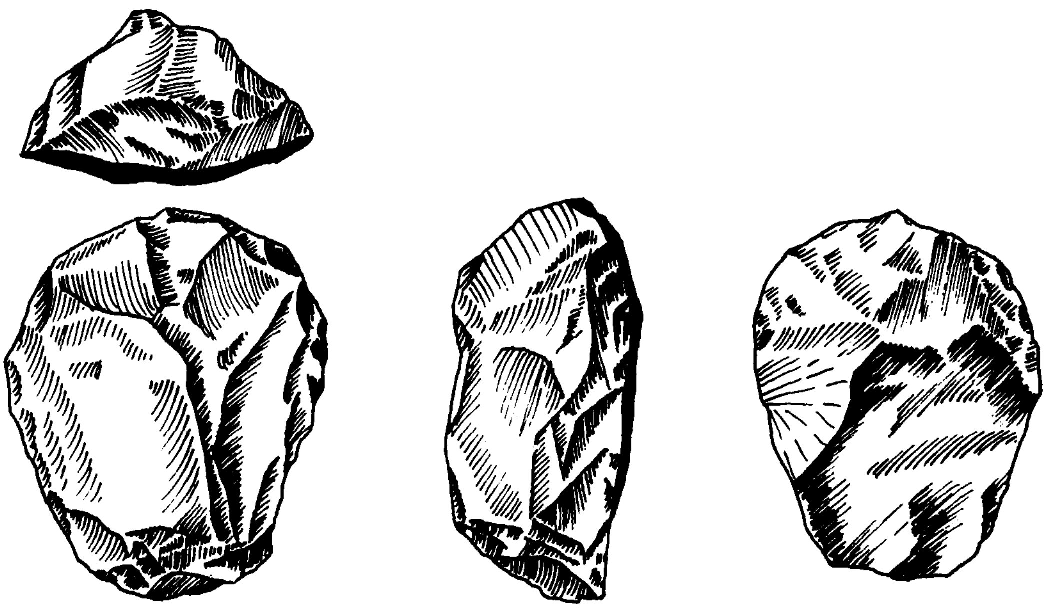
Table 8-5. Summary Statistics for Uniface Subcategory in the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
End Scraper	10	41.7	6
Large	12	50.0	7
Fragment	2	8.3	1
TOTALS	24	100.0	10

Table 8-6. Summary Statistics for Edge Modified Flakes and Chips in the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
End Scraper	53	9.9	22
Pointed End	37	6.9	16
Notched	6	1.1	3
Tabular Pieces	18	3.4	11
Alternate Faces	21	3.9	12
Opposing Margins	55	10.3	18
Generalized Bifacial	16	3.0	9
Generalized Unifacial	327	61.5	44
TOTALS	533	100.0	65

a (24LN1073-13)



b (24LN1076-1)

Figure 8-16. Unifaces (actual size): (a) end scraper; and (b) large.

little evidence of pressure flaking along any of the margins. They are more nearly ovate in shape and considerably larger (ca. 5.5 x 3.9 x 1.6 cm) in size than are the end scrapers. The third class--fragments--contains only two edge fragments that are not complete enough to be placed into one of the other classes.

Edge Modified Flakes and Chips (N=533)

This subcategory includes the bulk (i.e., 46.5%) of the flaked lithic tools. As the name indicates, these artifacts are made predominantly by flaking the margins (i.e., flake scars are not invasive) of flakes and chips. Some of the artifacts in this subcategory, specifically tabular pieces, may have been manufactured using naturally occuring pieces of stone that may have "weathered" from larger chunks of platy material like mudstone or argillite.

Classification of edge modified flakes and chips is based primarily on the location of the edge modification. The various classes are quite similar to the subclasses and types of scrapers and retouched pieces in the LAURD collection (Singleton 1982). Summary statistics are presented in Table 8-6. Examples of edge modified flakes and chips are illustrated in Figure 8-17. Each class is discussed briefly in the following paragraphs.

Specimens in the end scraper class (N=53) are much like the unifaces classified as end scrapers, except that those in the edge modified subcategory exhibit less invasive flake scars. They also equate to "end scrapers" in the LAURD project (Singleton 1982). Artifacts with two flaked margins that meet at a point are herein termed pointed end (N=37). They tend to be made on relatively thin flakes that are plano-convex to biplano in cross section. The lack of pointed ends that are diamond or wedge shaped in cross section indicates that these artifacts are unlike those termed perforators or gravers in the LAURD collection. Six flakes with at least one notch on an edge were identified and are similar to the five artifacts classified as "notches" made on flakes and perhaps to some of the single-notched artifacts made from tabular materials in the LAURD collection. The 18 tabular pieces are made from various sizes of thin, platy mudstones and they are virtually identical to the "argillite knives" in the LAURD collection. The alternate faces (N=21) and two margins (N = 55) classes of the edge modified flake subcategory are similar in that both are flaked primarily on two, generally opposing margins. They differ in that the two-margin artifacts are flaked on one face, while those in the alternate faces class are flaked unifacially, but on opposite faces of two margins or edges. Both classes of artifacts are quite similar to those termed side scrapers in the LAURD collection.

Only 16 of the edge modified artifacts (excluding several in the tabular pieces class) exhibit bifacially flaked margins. They are classed as generalized bifacial, edge modified flakes and they vary considerably in size. This particular class of artifact is not identified in the LAURD collection, but it is likely that artifacts with

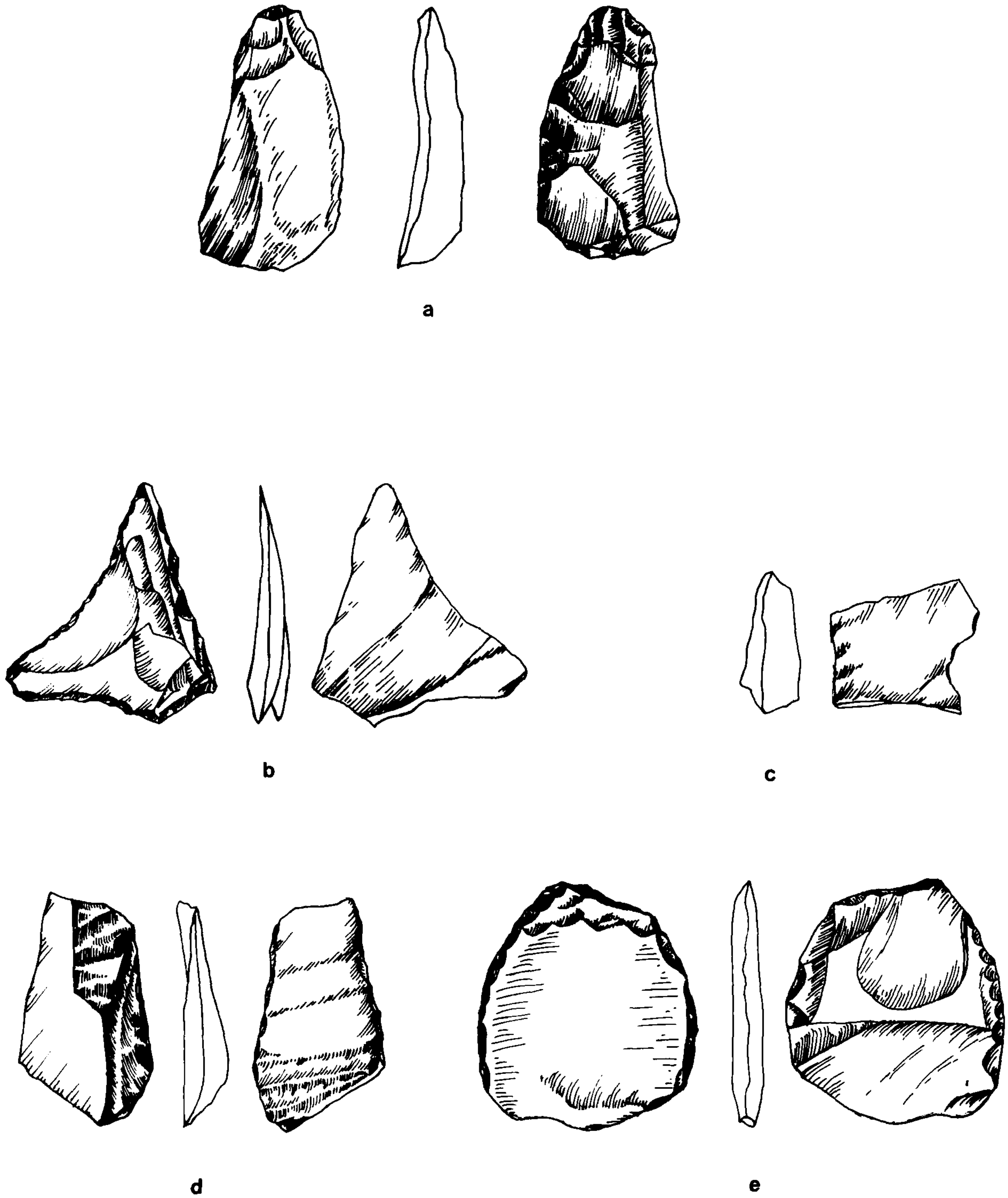


Figure 8-17. Classes of Edge Modified Flakes and Chips (actual size): End scraper a, Pointed End b, Notched c, Unifacial d, and Bifacial e.

bifacially flaked margins are included in the flake scraper and/or retouched pieces categories. The largest class of artifacts in the edge modified flake subcategory is termed generalized unifacial. There are 372 unifacially modified artifacts in this class and they vary greatly in size and shape. Artifacts in this class include, but are not limited to, those modified by noninvasive flaking along portions of one margin, all of one margin, two adjacent margins (e.g., an end-side-scraper), three margins, and all margins. Also included are artifacts termed "edge damaged flakes and chips" (e.g., utilized flakes). In this case macroscopically detectable flake scars are small, somewhat irregular and not very characteristic of deliberate flaking. Rather, the modification of the edge(s) may be the result of intentional use of an unmodified flake as a tool. However, other mechanisms for edge damage such as trampling by humans or other animals, natural turbation process, and even the infamous "bag wear" must be recognized as potentially significant in the "manufacture" of edge damaged flakes. On the whole, the generalized unifacial class of edge modified flakes and chips equates with the retouched flakes of the retouched pieces category in the LAURD collection.

Overall, the classes of artifacts within the edge modified flakes and chip subcategory are similar to the equivalent groups in the LAURD collection. Relative frequencies vary from class to class between the two collections, but they too are similar. In general terms, edge modified flakes and chips and their LAURD equivalents constitute between 40 and 50 percent of the tools in both collections. There are, however, some notable differences. Most notable is the fact that over 50 percent of the LAURD artifacts equivalent to the edge modified flake and chip subcategory are made from chert or cryptocrystalline materials (Singleton 1982:I.40, I.52) while less than 10 percent of those herein described are made from similar materials. Comparison of metric data for the various kinds of edge modified flakes and chips indicates that large and thick specimens are more common in the collection recovered from the higher terraces than in the LAURD collection. It seems probable that the material type and size differences are measures of differential land use patterns from both temporal and behavioral perspectives.

Edge Modified Cobbles (N=45)

Edge modified cobbles include three classes of artifacts, all of which are made on cobbles or split cobbles as evidenced by the presence of stream worn cortex. These artifacts differ from edge modified flakes and chips because they are made on the cobbles or a major portion thereof, as opposed to being made from flakes detached from cobbles. Another difference is that the edge modified cobbles are significantly larger than those in the flake/chip subcategory.

The 45 edge modified cobbles represent approximately 3.9 percent of the 1,149 flaked lithic tools in this collection. They are subdivided into three classes based on the kind and location of flake scars. Summary statistics are provided in Table 8-7 and selected specimens are

illustated in Figures 8-18 and 8-19. Cobbles that are flaked along both faces of the same margin are classed as bifacial (N=11), and those flaked along one face of one or more margins are unifacial (N=24). These two classes are similar to the 13 choppers (6 unifacial and 7 bifacial) in the LAURD collection (Singleton 1982:I.57). The 10 notched cobbles are artifacts commonly referred to as binotched net weights. These are most like the 67 notched pieces in the LAURD collection that are made from cobbles/pebbles and tabular materials (Singleton 1982:I.47-50).

Edge modified cobbles and their equivalent artifact types in the LAURD collection are similar in size, shape, and raw material to those in this collection. They differ in two respects. First of all, notched cobbles or net weights are much more common in the lowest terrace (i.e., LAURD) assemblage. This might well be expected because all of the LAURD sites are comparatively nearer the Kootenai River than are the sites dealt with in this project. In the second place, bifacially and unifacially edge modified cobbles are more common on the higher terraces. This difference is consistent with the overall pattern that large, heavy tools are more common on the higher terraces in comparison to the lowest terraces.

Nonflaked Lithic Tools

Artifacts in this category are all considered to be tools, in that they were used to alter the form or location of a second object (Harris 1975:55). Artifacts in this category exhibit macroscopically obvious evidence of use on their surfaces. Nonflaked lithic tools equate with various kinds of tools--hammerstone, grooved maul, edge-ground cobble, and basin grinder--in the LAURD classification system (Singleton 1982:I.56-59).

Nonflaked tools constitute approximately 11.1 percent (i.e., 144 of 1,293 tools) of the lithic tools (flaked plus nonflaked) in this collection, but similar artifacts represent only 1.6 percent of the lithic tools (i.e., 29 of 1,855 tools) in the LAURD sample (Singleton 1982:I.2).

The 144 artifacts in this category were divided into four subcategories based on the kind of surface modification, namely, battered, ground, pecked, and incised. Table 8-8 provides summary statistics for this category. The various subcategories are discussed briefly in the following paragraphs; more detailed descriptions are presented in Appendix D.

Battered Stone Tools (N=99)

These artifacts exhibit battered surfaces, usually evident as discrete areas of indentations that disrupt the stream worn cortex of the cobble. The battered stone tool subcategory is made up of three artifact classes, each defined on the basis of the location of the indentations or battering scars. Table 8-9 provides summary statistics.

a (24LN1054-135)

b (24LN1054-1357)

c (24LN388-215)

d (24LN1054-1433)

Figure 8-18. Edge modified cobbles (actual size): unifacial b, d and bifacial a, c.

a (24LN1148-79/S/1)

b (24LN396-6)

c (24LN1073I-79/S/38)

d (24LN427-1)

Figure 8-19. Edge modified cobbles (actual size): notched class a-d.

Table 8-7. Summary Statistics for the Edge Modified Cobble Subcategory in the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
Bifacial Cobble	11	24.4	7
Unifacial Cobble	24	53.4	11
Notched Cobble	10	22.2	8
	45	100.0	20

Table 8-8. Summary Statistics for the Nonflaked Lithic Tool Category in the Morphological/Technological Analysis.

Subcategory	Number of Specimens	Percent of Category	Number of Sites Represented
Battered Stone	99	68.8	28
Ground Stone	34	23.6	20
Pecked Stone	9	6.2	7
Incised Stone	2	1.4	1
TOTALS	144	100.0	40

Table 8-9. Summary Statistics for the Battered Stone Tool Subcategory in the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
Face/Faces	8	8.1	5
Edge(s) and Face(s)	13	13.1	8
End(s) and/or Side(s)	78	78.8	23
TOTALS	99	100.0	28

Eight artifacts are in the face/faces class. The battered area tends to be small, quite discrete and located near the center of one or both faces. These artifacts are like those often referred to as anvil stones. Similar artifacts were not identified in the LAURD collection. The vast majority (78 of 99) of artifacts in the battered stone subcategory are classified as being battered on the end(s) and/or side(s) (i.e., along one or more edges). These are the kinds of artifacts frequently called hammerstones and they are also the most common (25 of 29) type of nonflaked lithic in the LAURD collection (Singleton 1982:I.2, 57). An additional 13 artifacts in the battered stone subcategory are classified as exhibiting battered surfaces on the edge(s) and face(s). These are the kind of artifacts that could be termed hammerstones/anvils. Similar artifacts were not identified in the LAURD collection.

Battered stone artifacts constitute 7.7 percent of the lithic tools in this sample and only 1.3 percent of those in the LAURD collection. If those battered on the edges are hammerstones used during lithic tool manufacture, then it could be argued that this difference is expected because cores are better represented here than they are in the LAURD collection. Alternatively, if these and other battered stones tools are indicative of butchering activities, such as breaking bone (cf. Singleton 1982:I.58), or other food quest activities, including processing vegetal foods, then the two collections may represent different land use patterns. Regardless of the kinds of activities represented by these tools, they appear to have been more common on the higher terraces than on the low terrace (i.e., LAURD sites).

<u>Ground Stone Tools</u> (N=34)

This category includes all artifacts exhibiting surfaces that appear to be ground in that they are comparatively smooth and faceted. In fact, it is primarily the faceted nature of ground surfaces on relatively coarse grain stone that distinguishes ground from pecked or battered stone tools. Most ground stone tools are made on stream worn cobbles. Ground stone tools include three artifact classes, each of which is defined on the basis of the location of the ground surfaces. Table 8-10 provides summary statistics.

The edge edges class is best represented and includes 21 artifacts. These artifacts are known commonly as edge-ground cobbles and only one is included in the LAURD collection (Singleton 1982:I.59). Those in this sample exhibit one, two, or four ground edges. The ground edges are all faceted, but in terms of smoothness they range from a rather coarse texture (i.e., resembling a finely pecked surface) to almost polished surfaces. There seems to be no real consensus concerning the function of these tools, though uses in processing vegetal materials or hides, or even in the manufacture of flaked stone tools are often cited.

The ground stone subcategory also includes seven artifacts classified as face/faces. Most of them are made on stream worn cobbles. This class includes one artifact that would probably be termed a metate

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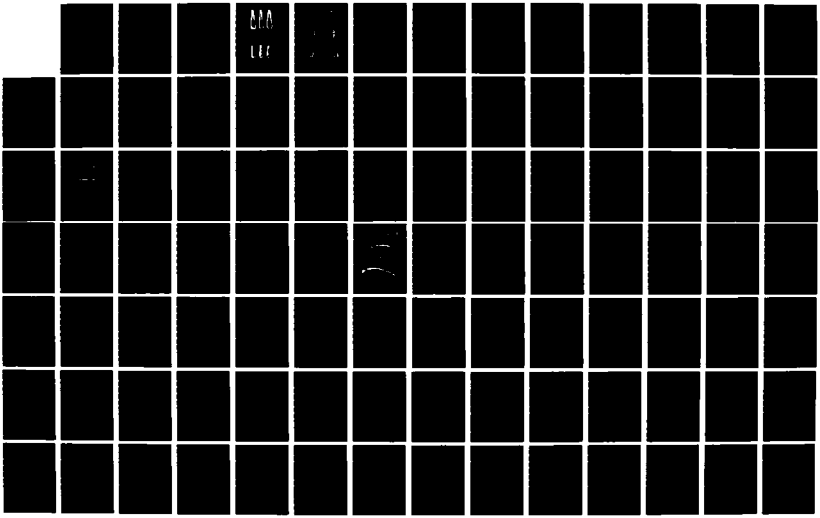

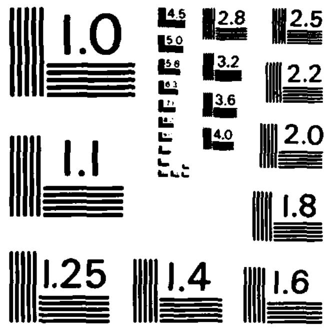

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Table 8-10. Summary Statistics for the Ground Stone Tool Subcategory the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
Face/Faces	7	20.6	6
Edge/Edges	21	61.8	14
Ground Face/ Battered Edge	6	17.6	6
TOTALS	34	100.0	20

Table 8-11. Summary Statistics for the Pecked Stone Subcategory in the Morphological/Technological Analysis.

Class	Number of Specimens	Percent of Subcategory	Number of Sites Represented
Pestle	5	55.6	5
Grooved Abraider	2	22.2	2
Grooved Maul	1	11.1	1
Full Grooved Stone	1	11.1	1
TOTALS	9	100.0	7

or basin grinder, several that might be considered manos or hand held grinding stones, and two multifaceted sandstone tools often referred to as abraders. In terms of equivalent artifact types, the LAURD collection contains only one item in this class, and it is designated as a basin grinder (Singleton 1982:I.59). Six artifacts in this collection are classified as ground face/battered edges and most of them also are made from stream worn cobbles. These items tend to have faceted, relatively smooth surfaces on one or both faces and irregular, indented surfaces on one or more edges. The battered edges are faceted and somewhat smooth on some specimens; as such, they resemble edge-ground cobbles. Similar specimens are not present in the LAURD collection. In a more traditional sense the ground face/battered edge class of artifacts might be called the mano/hammerstone/edge-ground cobble category of multiple purpose tools. It is not readily apparent how these tools were used, but a range of uses, at least as varied as those postulated for edge-ground tools, seems possible.

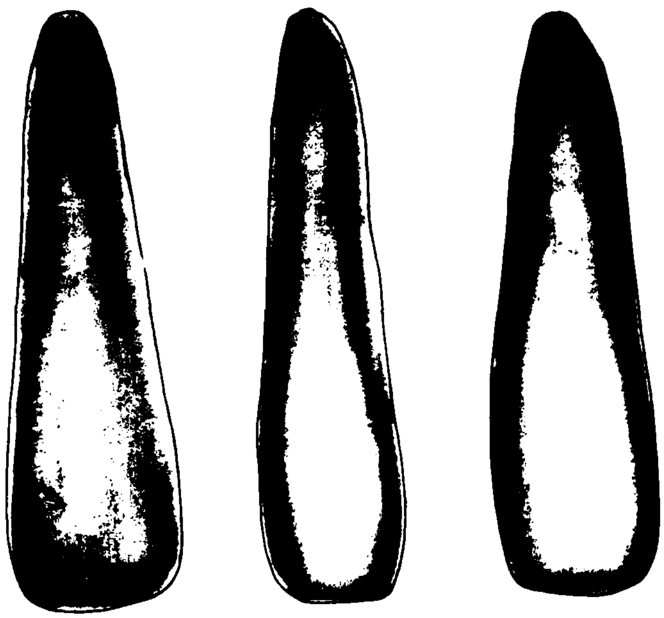
Pecked Stone Tools (N=9)

The pecked stone subcategory is limited to nine items representing four classes (Table 8-11). Classification of the pecked stone tools depends more upon shape and presumed function than upon technological attributes. The names used to designate classes--pestle, grooved abrader, grooved maul, and full grooved stone--are virtually self-explanatory. Pestles tend to be pecked over most of their surfaces (Figure 8-20), grooved abraders (i.e., shaft smoothers) exhibit a pecked and ground linear channel on one face (Figure 8-21, a, c), while grooved mauls and full-grooved stones have a pecked, curvilinear groove around the object. The function of the single, full-grooved stone (Figure 8-21b) in this collection is not readily apparent, though similar artifacts have been termed net weights, bola stones, or sounding rocks. Only two pecked stone artifacts--grooved mauls--are in the LAURD collection (Singleton 1982:I.58-59).

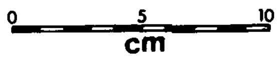
Incised Stone (N=2)

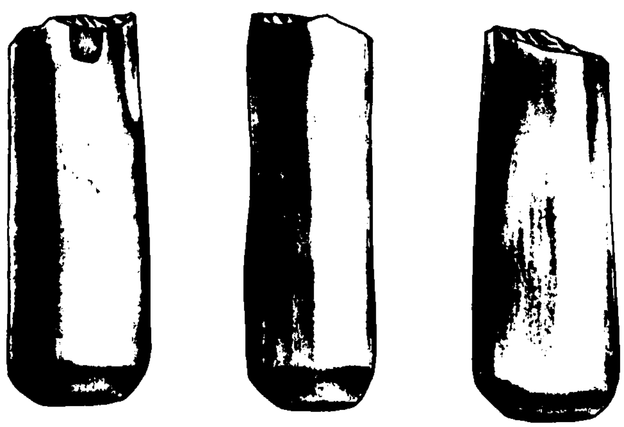
The remaining subcategory of nonflaked lithic tools is termed incised stone. There are only two items in this group. One is a cylindrical cobble with a well-formed, lattice-like pattern incised into one end. The other is a subrectangular specimen of tabular schist-like material with a series of straight to curvilinear, thin, shallow incisions on one flat surface. The function of both these items is unclear and a purusal of regional literature failed to reveal similar artifacts and none are described for the LAURD collection.

As was noted in the beginning of this section, nonflaked lithic tools are far more abundant in the collections from the higher terrace sites than they are in the LAURD collection. This difference may be related to another observed difference; namely, the fact that large, thick tools are more common in the higher terrace assemblage. Regardless of how the functions of these tools are interpreted, the



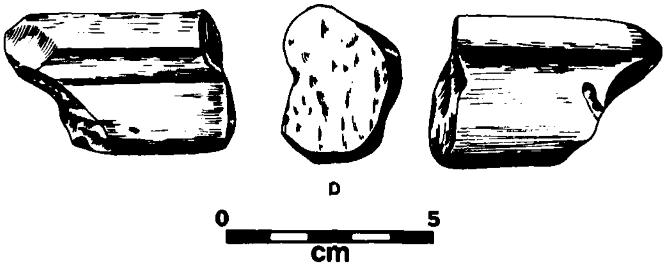
a
(24LN1066-2)



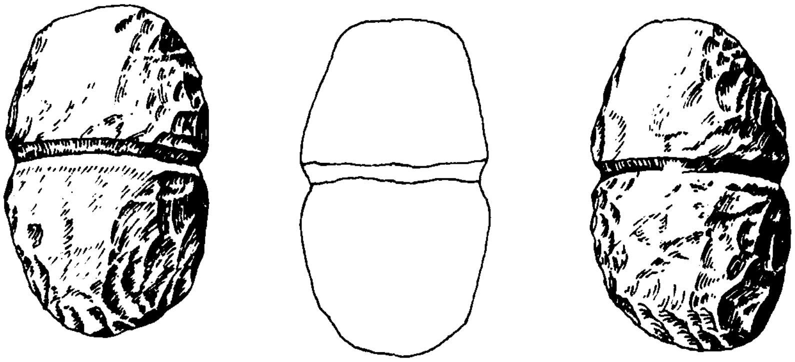


b
(24LN1055-13)

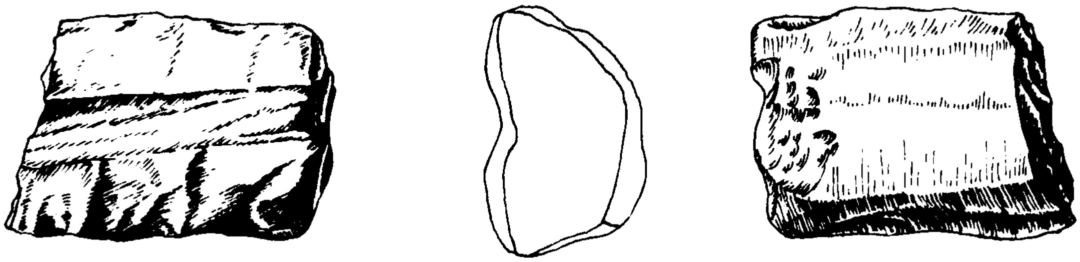
Figure 8-20. Pecked stone, pestle class a and b.



a
(24LN1054-292)



b
(24LN1054-446)



c
(24LN189-79/S/4)

Figure 8-21. Pecked stone, straight (linear) groove a and c, and curved groove b.

differences between the two assemblages probably are indicative of different land use patterns, perhaps at different points in time.

Unaltered Rock

These rocks occurred at many sites, but only a few specimens were collected. Unaltered rocks vary in sizes and shapes, ranging from small, rounded river cobbles, to large discoidal river cobbles and flat tabular pieces from local bedrock outcrops. Although these rocks do not exhibit readily apparent use wear, they are considered to be artifacts because their occurrence at sites is the likely result of human actions. The nature of ecological/sedimentological conditions at sites where unaltered rocks were recorded ruled out natural processes to explain their presence. This determination was relatively easy to make at sites on sand dune or sandy bar/terrace landforms, but at sites on rocky landforms like fans or debris flows, it was much more difficult to determine whether the rocks were out-of-place. In those cases the spatial arrangement of rocks, as opposed to their size or shape, was the best indicator of an out-of-place character. Unaltered rocks were distinguished from those uncracked rocks likely to be part of a fire-cracked assemblage primarily on a contextual basis. That is, rocks spatially associated with a scatter or concentration of obviously fire-cracked rocks were considered to be fire-cracked rocks as opposed to unaltered rocks.

The functions of unaltered rock probably vary considerably, but they were seldom obvious to the field or laboratory investigators. In one case (site 24LN1058), large, unaltered rocks were concentrated in a small area and spatially associated with several thin, edge modified flakes (i.e., "scrapers") and thin bifaces, including a projectile point fragment. This may be an indication that some of the larger unaltered rocks were related to hide and/or meat processing activities, such as securing hides while they were being scraped. Other small, unaltered cobbles also may be related to hide processing activities like rubbing and light pounding to soften hides (cf. Ewers 1958). Still other rocks might have served as seats, small tables or working surfaces, or weights for securing camp goods or tent coverings. In recognition of the common occurrence of unaltered rocks and their assumed importance and varied uses, they are referred to as furniture rock.

Analysis of furniture rock was limited primarily to brief field descriptions and plotting their locations on site maps. A more detailed inspection for use wear was made of collected specimens and as a result several of the smaller ones were placed in the edge-ground cobble class. Although this limited analysis yield results that obviously are significant, there can be little doubt that a more detailed spatial analysis would provide information fundamental to the recognition of intrasite patterns, particularly those indicative of specific kinds of activities.

Fire-Cracked Rock

Pieces of rock small to medium (ca. 2-20 cm diameter) in size, black, brown, and reddish in color and usually fractured into pieces with rough, sharp surfaces and edges are termed fire-cracked rock. These are the kinds of rock that occur repeatedly in concentrations generally considered to be "hearths" or piles of "stone boiling rocks."

Field analysis of fire-cracked rock (FCR) usually was confined to mapping the obvious concentrations and characterizing the relative density of scattered pieces. At tested sites FCR usually was counted, weighed, and discarded (as specified in the contract) after making estimates of average sizes and material types. In numerous cases, the FCR was collected and analyzed (i.e., sizes, counts, weights, material types recorded) in the field laboratory, then it was discarded. In recognition of the potential importance of FCR as an aid to interpreting site function, samples from several sites were retained for future analysis.

There is evidence that functional distinctions among various kinds of FCR can be made (Schalk n.d.; House and Smith 1975; Draper and Stanfill n.d.). At least two major kinds of uses are recognized for FCR in the regional ethnographic record, namely in/on the ground for lining and/or cooking in hearths and in water for boiling various food stuffs (Smith 1984). Other experiments (e.g., Draper and Stanfill n.d.), as well as the controlled but limited ones carried out for this project provide a strong indication that these two kinds of FCR can be distinguished primarily on the basis of fracture patterns (Schalk n.d.). The limited experiment conducted for this project entailed heating rocks to a known temperature and then allowing them to cool either slowly in the open air (as in a hearth or oven) or rapidly in water (as in the case of stone boiling). FCR that fractures during the heating process probably includes those pieces used to line hearths, probably as a means of reducing heat loss, as well as pieces heated so as to provide a kind of grill or heat source for cooking foods lying on or near the rocks. FCR used in that manner (Schalk n.d.; Draper and Stanfill n.d.) tends to fracture in a curvilinear fashion, frequently producing large and small spalls and "potlids" (Crabtree 1972). That basic pattern was observed on rocks heated and fractured in the furnace during limited experiments conducted for this project. Rocks that fractured upon being cooled rapidly in water (i.e., those used for stone boiling) exhibit angular fracture patterns (as opposed to curvilinear) and produce blocky chunks.

Various kinds of rocks such as basalts, sandstones, and quartzites tend to break in the patterned fashion described in the preceding paragraph (Draper and Stanfill n.d.). Observations on and resulting interpretations about FCR from the study area indicate that medium size (ca. 10-20 cm) quartzite cobbles tend to exhibit angular fracture patterns suggesting they were used frequently for stone boiling. Very platy mudstone, as well as granitic rocks and granodiorites, also exhibit the curvilinear fracture pattern. These FCR are interpreted as being used and fractured mainly in hearths. The FCR analysis was very preliminary but the results indicate that further investigation would be fruitful.

Enough FCR has been retained in the collection to allow for additional analysis as tests of some of the ideas presented above. Furthermore, the information already gathered could be used to carry on more detailed analysis aimed at assessing land use patterns. For example, zones, locations, and/or landforms could be characterized according to the dominant kinds of FCR present at sites. By comparing these results to that portion of the ethnographic record that stipulates what kinds of foods are associated with different kinds of FCR and during which seasons stone boiling versus roasting or pit cooking characteristically occurred, it should be possible to construct testable models. Testing such models dictates that careful attention be given to monitoring material types and fracture patterns that characterize FCR.

Raw Material Types

The system employed to classify lithic raw material types was designed to monitor variability at a general level and to be compatible generally with the LAURD scheme (Singleton 1982:I.10). As noted earlier, the overall objectives of the lithic analysis were to address questions regarding changes through time in home ranges and/or trade patterns, and to gain a better understanding of the overall lithic assemblage. Malouf (1956a) and Choquette (1980-1981) are among those who argue that the utilization of chert-like or cryptocrystalline materials increased through time. Alternatively, data from the LAURD project indicate little change in the use of chert through time, at least not during the last few thousand years (Singleton 1982:I.74). Because chert materials are not known to occur naturally in the project area, their presence suggests that ranges of aboriginal groups encompassed areas where chert occurs naturally and/or chert was acquired through some kind of trade network. The point here is not to argue that the kinds of chert materials found in the project area demonstrate that specific groups of people moved into or out of the middle Kootenai River Valley at specific points in time (cf. Choquette 1980-1981; Choquette and Holstine 1980:35-50). Rather, the objective is to examine the question of the differential use of raw materials through time and address the implications of these changes, especially in terms of land use patterns.

In keeping with the general approach, and attempting to avoid detailed questions regarding lithic raw material types and sources, three general subclasses or types of raw materials and a catchall miscellaneous group termed "other" are defined for this study. Lithic tools and debitage (excepting shatter and other small flakes) are categorized according to the types of raw materials which they are made (Table 8-12). This system is compatible with and, in fact, was derived from the schemes employed for the LAURD project (Singleton 1982). The term mudstone is employed here to describe the most common (i.e., 66.4% of the classified flakes/chips) kind of lithic debris in the project area. Mudstone encompasses metamorphosed clays, silts, siltstones, claystones, shales, and argillites. Materials in this subclass tend to be black in color, but colors range from greys to browns to green to tan. Macroscopically, grain sizes are not readily detectable but the

Table 8-12. Summary Data for Raw Material Type Distributions Among Artifact Subcategories in the Morphological/Technological Analysis.*

Artifact Subcategory (number of artifacts)	Mudstone		Chert		Quartzite		Other	
	N	%	N	%	N	%	N	%
Flake/Chip (27,895)	18,519	66.4	2,551	9.1	6,825	24.5	NA	
Core (185)	142	76.8	1	0.5	41	22.2	1	0.5
Edge Modified Cobble (45)	37	82.2	0	0.0	6	13.3	2	4.5
Edge Modified Flake/Chip (533)	419	78.6	51	9.6	59	11.1	4	0.7
Uniface (24)	15	62.5	4	16.7	4	16.7	1	4.1
Nonhaft Biface (325)	209	64.3	13	4.0	95	29.2	8	2.5
Haft Biface (222)	138	62.2	74	33.3	10	4.5	0	0.0
Battered Stone (99)	27	27.3	0	0.0	44	44.4	28	28.3
Ground Stone (34)	2	5.9	0	0.0	5	14.7	27	79.4
Pecked Stone (9)	3	33.3	0	0.0	1	11.1	5	55.6
Incised Stone (2)	0	0.0	0	0.0	0	0.0	2	100.0

*The debitage subcategory of shatter (n=1,567) and the class of other/small flakes (n=1,261)are not included because these items were not subdivided by material type.

materials tend to be banded or laminated in appearance. Mudstones exhibit subconchoidal fracture patterns and their platy structure is often made apparent by the presence of many step-scars on flaked specimens. However, flake scars may crosscut bedding planes or parallel them depending in part on the degree of metamorphosis. Grain size/texture, translucency and color can be used to subdivide mudstone into a number of classes (e.g., black, opaque, very fine grain mudstone or brown, opaque, fine grain mudstone). Mudstones are equivalent to "fine grained materials" and claystones in the LAURD system (Singleton 1982) and to the "Purcell Siliceous Siltstone" and Kootenay Argillites defined by Choquette (1980-1981). It is likely that the black and brown basalts as well as the brown siliceous mudstone materials recovered from sites along the lowest terraces in the project area (Taylor 1973) are equivalent roughly to the mudstone subclass. Experience with raw materials in the study area and elsewhere in the Northwest indicates that metamorphic mudstones are often confused with basalt because they look so much alike. This is especially evident in areas where basalt does not occur naturally, but the investigators are accustomed to dealing with basalt as a common raw material.

As noted, the locally available cobbles probably provided the source for most of the mudstone artifacts in this collection. The fact that all but one of the corticated mudstone cores exhibit stream worn cortex similar to the mudstone cobbles in local gravel deposits, supports this contention. If chunks or cores of mudstone had been quarried from point sources for the Purcell Siliceous Siltstones or other materials and transported to the this part of the Kootenai Valley (cf. Choquette 1980-1981), one would expect more than one of the 108 corticated cores or the 63 thick biface (Biface I and II) made from mudstone to exhibit evidence of a weathering rind characteristic of lithics extracted from bedrock quarries. Although, this does not seem to have occurred on a regular basis, the remote possibility remains that entirely decorticated blanks, preforms, large flakes, or finished tools were made from materials extracted from the known quarries and transported regularly to the study area. This probably did occur to a limited degree. However, with the possible exception of Kootenay Argillite, the dominant pattern at sites on the higher terraces is utilization of locally available mudstone. Mention should also be made of the fact that some investigators argue that Kootenay Argillite outcrops locally (Singleton 1982:I.62), while others note that it was available only in the Kootenay Lake area of south-central British Columbia (Choquette 1980-1981:32-33). Investigations related to this project did not focus on that issue, but it is clear that additional data are needed before the problem is resolved.

The second most common (i.e., 24.5% of the classified flakes/chips) raw material type in the collection is quartzite. For purposes of the study, quartzite is defined as a granulose metamorphic rock consisting essentially of quartz. It generally exhibits rough conchoidal fracture surfaces but can fracture along bedding planes. Grain sizes are within the sand range and are thus detectable macroscopically. Colors range from black to almost white, but browns and reds are most common. Quartzites can be subdivided on the basis of color, translucency, and

grain size/texture. They are equivalent to the various colored quartzites from sites along the lowest terraces in the area (Taylor 1973) and to the "coarse-grained" category encompassing quartzite, some sandstones, and quartz in the LAURD system (Singleton 1982). Quartzites are available from local gravels and probably were utilized on a regular basis by the aboriginal occupants of the area. This contention is supported by the facts that all corticated quartzite cores in this collection exhibit stream worn cortex and the quartzite tools tend to include a high percentage of large items (i.e., the kind usually not transported over great distances by people).

Chert is the least common material type, representing only 9.1 percent of the flake/chip subcategory (see Table 8-12). As employed herein, chert includes all cryptocrystalline and microcrystalline rocks frequently termed flint, jasper, chalcedony, opal, agate, chert, chert-like, and so on. Individual grains or clasts in the raw material can not be seen macroscopically. Cherts tend to exhibit conchoidal fracture patterns and they can be banded, mottled, or unmottled in appearance. Both translucent and opaque forms occur and there is considerable variation in the consistency of the matrix (i.e., some forms have fossil inclusions or marked variation in overall texture). Chert, as used here, is synonymous with "cryptocrystalline" (which encompassed Kootenay Argillite) in the LAURD system (Singleton 1982) and with color designated cherts as well as chalcedonies in the collections from sites on the lowest terraces in the project area (Taylor 1973). In this collection, specific types of raw materials similar to the red to yellow, Madison Limestone chert from areas to the southeast of Lake Koocanusa (Davis 1981; Choquette and Holstine 1980), the predominantly grey to black Top-of-the-World chert from areas to the northwest (Choquette 1980-1981), and the fossiliferous Avon chert from near Helena, Montana (Reeves 1978), are encompassed by the chert type.

Unlike the mudstones and quartzites, cherts do not appear to be available locally. Not only were chert cobbles not observed in local gravel deposits, but only one (a small riverworn cobble split using a bipolar technique) of the 185 cores was made from chert. Furthermore, none of the large, heavy bifaces is made from chert, and only one of the chert tools (a large uniface) is thicker than 1.5 cm. These data strongly indicate that chert blanks, preforms, and large flakes were brought to the sites on the higher terraces, as opposed to being produced there.

Interestingly, the relative frequency of chert tools in the edge modified flake/chip subcategory (i.e., 9.6%) is about the same as the frequency of chert flakes/chips in the debitage category (Table 8-12). It seems likely that many, perhaps most, of these tools were made on flakes generated from the bifacial reduction of larger flake blanks and relatively thin, unnotched bifaces (i.e., Biface III and IV). Slightly over half (52.1%) of all the chert tools are classified as haft bifaces and most of these are projectile points. These observations illustrate that chert raw materials were a limited resource in comparison to mudstones and quartzites and that chert was utilized differentially.

The vast majority of flaked lithic artifacts were made from one of the three major types, but there were exceptions and those artifacts were classified as "other." Most of the "other" raw materials were granitic, granodiorites, and miscellaneous coarse grained metamorphic rocks found in local gravel deposits (Table 8-12). This is the case for most of the nonflaked lithic tools (i.e., battered, ground, pecked, incised) characterized as being made from "other" raw materials. Sandstone was used for some of the ground stone tools, and in one case pumice was used. The nonhaft bifaces classed as "other" are largely granitic and granodiorite materials, as are the edge modified cobbles and the cores classified as "other." Artifacts that appear to be made from volcanic glass (e.g., obsidian) are represented by one small uniface, one Biface IV fragment, and four edge modified flakes. However, these artifacts have not been subjected to detailed analysis that would determine whether they are, in fact, obsidian and if so what is the source. Considering that Top-of-the-World chert and obsidian can appear quite similar (Choquette 1983:personal communication), the designation of artifacts as being made from obsidian should be considered as preliminary.

Data presented in the preceding paragraphs and summarized in Table 8-12, 8-13, and 8-14 demonstate clearly that lithic raw materials were utilized differentially and in a patterned fashion. Mudstone is the most common material used in the manufacture of flaked lithic tools. There is reasonable correspondence between the proportion of mudstone debitage and mudstone tools. Mudstones account for the majority of cores (Table 8-13), tool subcategories (Table 8-12) and classes (Table 8-14), with the exception of the Biface I and end scraper uniface classes. These two exceptions are indicative of other broad patterns; quartzites tend to be used to manufacture large, heavy tools (e.g., Biface I) and cherts tend to be used for small, more delicate tools (e.g., end scraper unifaces).

There is a reasonable correspondence between the proportion of quartzite debitage (e.g., cores and flake/chip) and tools, albeit not as close as for mudstone (Table 8-12). The tendency for quartzite to be used to manufacture larger, heavy tools is manifested in the comparatively high proportion of Biface Is and IIs, generalized bifacial flakes (a class of edge modified flake), and bifacial cobbles (Table 8-14). Given the assumption that larger tools are likely to be employed for heavy-duty tasks such as pounding and chopping, the high frequency use of coarse grained raw materials would be expected because those are the kinds of materials likely to sustain hard blows without breaking. The fact that quartzites are underrepresented in the subcategories and classes of relatively thin bifaces--those tools assumed to be used primarily for light-duty tasks like cutting and piercing--provides additional support for the contention that it tends to be used for heavy-duty tools.

The distribution of cherts among the various subcategories and classes of debitage and tools differs markedly from mudstones and quartzites. Chert flakes/chips are 20 times as common as are chert cores and chert hafted bifaces are proportionately three times as common

Table 8-13. Summary Data for Raw Material Type Distributions Among Classes of Cores in the Morphological/Technological Analysis.

Core Class (number of cores)	Mudstone N	Mudstone %	Chert N	Chert %	Quartzite N	Quartzite %	Other N	Other %
Decorticated (41)	27	65.9	0	0.0	13	31.7	1	2.4
Cobble (34)	27	79.4	0	0.0	7	20.6	0	0.0
Split Cobble (25)	23	92.0	0	0.0	2	8.0	0	0.0
Partial Cobble (75)	58	77.3	0	0.0	17	22.7	0	0.0
Bipolar (10)	7	70.0	1	10.0	2	20.0	0	0.0

Table 8-14. Summary Data for Raw Material Type Distributions Among Classes of Flaked Lithic Tools in the Morphological/Technological Analysis.

Tool Class (Number of Tools)	Mudstone N	Mudstone %	Chert N	Chert %	Quartzite N	Quartzite %	Other N	Other %
Biface I (29)	10	34.5	0	0.0	19	65.5	0	0.0
Biface II (92)	55	59.8	0	0.0	33	35.9	4	4.3
Biface III (166)	119	71.7	6	3.6	38	22.9	3	1.8
Biface IV (38)	25	65.8	7	18.4	5	13.2	1	2.6
Arrow Size (49)	27	55.1	21	42.9	1	2.0	0	0.0
Undetermined Size (7)	6	85.7	1	14.3	0	0.0	0	0.0
Moderate Dart (69)	42	60.9	25	36.2	2	2.9	0	0.0
Large Dart (58)	39	67.2	15	25.9	4	6.9	0	0.0
Other Haft Bifaces (12)	8	66.7	3	25.0	1	8.3	0	0.0
Dart Blade Fragment (27)	16	59.3	9	33.3	2	7.4	0	0.0
End Scraper Uniface (10)	4	40.0	3	30.0	2	20.0	1	10.0
Large Uniface (12)	9	75.0	1	8.3	2	16.7	0	0.0
Fragment Uniface (2)	2	100.0	0	0.0	0	0.0	0	0.0
End Scraper Flake (53)	46	86.8	5	9.4	2	3.8	0	0.0
Pointed End Flake (37)	28	75.7	7	18.9	2	5.4	0	0.0
Notched Flake (6)	3	50.0	1	16.7	2	33.3	0	0.0
Tabular Piece (18)	18	100.0	0	0.0	0	0.0	0	0.0
Alternate Faces Flake (21)	19	90.4	1	4.8	1	4.8	0	0.0
Two Margins Flake (55)	47	85.5	7	12.7	1	1.8	0	0.0
Gen. Bifacial Flake (16)	12	75.0	1	6.2	3	18.8	0	0.0
Gen. Unifacial Flake (327)	246	75.2	29	8.9	48	14.7	4	1.2
Bifacial Cobbles (11)	8	72.7	0	0.0	2	18.2	1	9.1
Unifacial Cobbles (24)	20	83.3	0	0.0	4	16.7	0	0.0
Notched Cobbles (10)	9	90.0	0	0.0	0	0.0	1	10.0
TOTAL (1,149)	818	71.2	142	12.4	174	15.1	15	1.3

projectile points characteristic of earlier time periods was highest on the higher terraces and the relative frequency of Late Prehistoric projectile point styles was highest on the lowest terraces. That pattern also is apparent when the distribution of phase diagnostic projectile points (Roll 1982) on highest and lowest terraces are compared (Figure 8-26). Less than 2 percent of the projectile points from the lower terrace are indicative of the Bristow Phase and its predecessor as opposed to almost 38 percent of the points from higher terrace sites. The frequencies of projectile points representative of the Calx and Kavalla phases are very similar for both samples suggesting that the time period between 4,500 and about 1,800 years ago is characterized by extensive occupation of both valley bottom and and valley wall locations. Soon thereafter the pattern begins to change. Projectile points representative of the Stonehill Phase (ca. 1,750 to 1,250 B.P.) are proportionately about three times as common on lower terraces than they are on higher terraces. Throughout the Warex (ca. 1,250 to 750 B.P.) and Yarnell (ca. 750 to 200 B.P.) phases the pattern of more extensive occupation on the lowest terraces continues. Those phases are characterized by bow and arrow hunting as opposed to atlatl and dart hunting, and represent little more than 1,000 years. Even so, almost half (47.1%) of the projectile points from sites on the lowest terraces are arrow points, while only 20.3 percent of those recovered from the higher terraces are considered to be arrow points.

Judging from the distribution of projectile points in the samples analyzed here, three basic land use patterns are represented (Figure 8-27). First, the higher terraces were the focus of Kootenai Valley utilization during Early and early Middle time periods (? Early and Bristow Phase in LAURD terminology). In the second pattern, both the higher and lowest terraces were occupied and presumably utilized throughout the late Middle Period (i.e., Calx, Kavalla, and Stonehill phases). The third land use pattern occurred during the Late Prehistoric Period (i.e., Warex and Yarnell phases) and is characterized by more intensive use of the lowest terraces and limited but significant use of the highest terraces.

This basic pattern--older sites on higher terraces and younger sites on lower terraces--was recognized long ago by Malouf (1956) as being characteristic of sites located around Flathead Lake. However, Malouf argued that sites were located along the lake's margin at various points in time. Thus, as Flathead Lake drained and/or dried out through time, the aboriginal inhabitants shifted their site locations and continued to occupy a lakeside environment. As is argued later in more detail, changing lake levels did not condition land use patterns in the project area, at least not during the last 10,000 years or so. Rather changes in the regional vegetation cover and probably changes in regional human population densities are important variables that conditioned settlement systems there.

archaeological data, especially where more direct chronological measures (e.g., radiocarbon and tree-ring dates, relative stratigraphic positions, and well dated volcanic ash deposits) are not available.

The general sequences of projectile point styles in the Northern Rocky Mountains (Malouf 1956b; Reeves 1978; Flint 1982), the Northwestern Plains (Frison 1978), the Columbia Basin (Leonhardy and Rice 1970), and the more southern parts of the Northern Rocky Mountains (Swanson 1972) are quite similar. In fact, the general stylistic sequences for much of North America are remarkably similar. The basic stylistic sequence for the projectile points in the project area and vicinity was established by Malouf (1956) and has remained relatively intact through the years (cf., Flint 1982). In broad and very general terms, the earliest styles tend to be large lanceolate and/or stemmed forms (Early Period) which are replaced by large side-notched forms (early Middle Period), which in turn, are replaced by a wide variety of corner-notched, and corner-removed forms (late Middle Period), and finally small, corner and side-notched styles (Late Period) dominates. The projectile point chronology developed in conjunction with the LAURD project and based on radiocarbon dates from local sites as well as typological cross-dating from adjacent areas (Roll 1982:5.7-5.23) is in basic agreement with the regional stylistic sequence.

Changes in the relative frequencies of projectile point types probably is not the ideal measure of change in land use patterns, but the approach can be useful. If is assumed that basic projectile point styles change through time in a known fashion and that projectile points are indicative of hunting activities, then other things being equal, changes in relative frequencies should be a measure of the intensity of hunting activitites in a given area. If hunting is the dominant subsistence activity through time in a given area, then the relative frequencies of point types characteristic of different time periods and places on the landscape should be a crude but reasonable yardstick for measuring changes in land use patterns.

The projectile point classification scheme used for this project is compatible with that used for the LAURD project, but not with the approach used to classify artifacts recovered during the University of Montana's field project (Taylor 1973). However, projectile points classified by Taylor (1973:74-94) can be regrouped in such a fashion as to correspond generally to the classes of points defined in this study. By comparing these samples, it should be possible to illustrate general land use patterns at least as they are evidenced by the distribution of projectile points considered to be diagnostic of broad time priods. Projectile point data used for purposes of the following discussion represent 17 sites on the lowest terraces and 55 higher terrace sites. The sample of classified projectile points from the lowest terraces include 505 specimens, while there are 153 projectile points in the higher terrace sample.

In an earlier section of this chapter, stylistic comparisons (Table 8-4) were made between projectile point types recovered during the LAURD project and those from the higher terraces. The relative frequency of

Although a core/flake industry represented mainly by the reduction of blocky cores is characteristic of the entire assemblage and of mudstone material in particular, there also is evidence that a core/tool industry may be represented. Biface Is and IIs, particularly those made from quartzite, may have functioned as cores. Wherein both flakes and the core nuclei tend to be the "blanks" for tool manufacture. Of the 121 artifacts in the Biface I and II classes, 46 of them fail to exhibit macroscopic use wear; 29 (63%) of those are made from quartzite. The possibility is recognized here that these thick quartzite and perhaps some of the mudstone bifaces are representative of the early stage in the manufacture of Biface IIIs and Biface IVs. This issue is far from resolved but it is noteworthy because large, thick bifaces, whether they are cores or tools, are all but absent from sites on the lowest terraces. In general, the reduction of cores is far better represented at sites on higher terraces. The core to flaked tool ratio for the LAURD collection is 1:27 (Singleton 1982:I.73) and for this collection it is 1:6.

Core reduction that is represented at the lower terrace sites in the LAURD project is dominated (59.4% of the cores) by mudstones or fine grain materials (Singleton 1982:I.62), as it is for sites on the higher terraces. The various cherts (excluding "Kootenay argillite") represent approximately 10 percent of the cores and 54.7 percent of the flakes and chips in the LAURD collection (Singleton 1982:I.62, I.70). Percentages for chert materials are far higher than those for the higher terrace flaked lithic artifact sample where reduction of chert cores hardly is represented. Some of these differences may be explained, in part, by a shift in land use patterns. During the earlier time period, groups focused on utilizing valley wall resources and occupied sites on the higher terraces. Later, the focus shifted to a more intensive utilization of valley bottom/riverine resources and occupation of sites on the lowest terraces. This shift in land use patterns is evidenced by the comparatively high frequency of late Middle and Late Prehistoric Period projectile points recovered from sites situated on the lowest terraces. Furthermore, late Middle and Late Period projectiles tend to be made from chert raw materials and chert debitage is far more common at sites situated on the valley bottom than at sites along the valley walls.

Projectile Point Distributions as Measures of Land Use Patterns

Traditionally, projectile points and typologies derived from them are the archaeologists' index fossils. As index fossils, use of projectile points vary greatly, from attempts to bring general chronological order to lithic assemblages to providing the primary material basis for local sequences and on to representing if not defining entire cultural systems. Uses and abuses of projectile point typologies abound in the literature and folklore of archaeologists. But the fact remains that there are patterns to the manner in which projectile point forms change through time. These patterns are useful because they do provide a means to bring broad chronological order to

Quartzites also represent a common raw material and they too are available from local gravel deposits. Quartzites account for 15.3 percent of tools, 22.2 percent of the cores, and 24.5 percent of the flakes and chips. The facts that two-thirds of quartzite cores exhibit stream worn cortex and that quartzite debitage and tools occur in similar frequencies argue that these materials were procurred from local gravel deposits. Quartzite as a raw material is best represented by the Biface I (70.4%), Biface II (35.9%), Biface III (22.9%), and battered stone (44.4%) tool classes. These are the larger, heavier tools. Quartzites occur less frequently in 19 other tool classes, but are not represented in the incised stone, notched cobble, tabular piece, uniface fragment, and undetermined size projectile point tool categories.

Cherts are not known to occur locally in gravel deposits or as bedrock outcrops and this is indicated by the fact that only 0.5 percent of the cores from higher terrace sites are made from cherts. In contrast, 9.1 percent of the flakes and chips are chert and 12.4 percent of all the flaked lithic tools are made from various kinds of cherts. Cherts are represented in all flaked lithic tool subcategories except edge modified cobbles. They are best represented in the Biface IV (18.4%) class of nonhaft bifaces, in the arrow size (42.9%), moderate dart size (36.2%), large dart size (25.9%), and the "other" (25%) classes of haft bifaces, as well as the pointed end (18.9%), notch (16.7%), and two margins (12.7%) classes of edge modified flakes. Characteristically, cherts in this collection are used to manufacture small, thin, light-weight tools, particularly those associated with piercing and cutting. Based on available evidence almost all of the chert recovered from the valley wall sites was transported there in the form of preforms, flake blanks and perhaps finished tools. Some of the preforms, flakes, and finished tools may have been produced at sites in the valley bottom, but the fact remains that the sources of chert materials lie well outside the project area.

Overall, the debitage in this sample is characteristic of a core/flake industry. In other words, the dominant reduction technology is one wherein flakes detached from cores, rather than the cores themselves, tend to be the "blanks" for tool manufacture. Reduction of blocky chunks and cobbles as opposed to large bifaces or unifaces is dominant. Presumably, a core/flake industry also characterizes the LAURD assemblage (Singleton 1982:I.61).

Of the 185 items classified as cores in this study, 134 (72.4%) are in multidirectional subclasses. Multidirectional cores are blocky in shape and they tend not to have edges that are functional in the sense they can be used as chopping or scraping tools. Only 28 of them (20.9% of the 134 multidirectional) have enough edge damage to suggest they were used as tools. The 41 artifacts classified as unidirectional cores tend to have functional edges and 21 (51.2%) of them have enough wear to be considered as heavy-duty tools in the functional analysis. Bipolar reduction is also represented in the collection but only 10 (5.4%) of the 185 cores are so classed and they may well have functioned as wedges.

would be expected to characterize an assemblage recovered from an area with abundant game animals. However, thin bifaces and projectile points occur in lower relative frequencies, and heavier tools like Biface Is and IIs, edge modified cobbles and battered stone occur in higher relative frequencies in comparison to the composite lowest terrace assemblage. These differences suggest that activities requiring the use of heavier tools are better represented in the higher terrace assemblage. Assuming that greater representation of a larger number of tool types is indicative of a wide range of well represented activities, it appears that a wide range of activities are better represented on the higher terraces in comparison to the lowest terraces. Seven of the ten tool types occur in frequencies less than 5 percent in the composite lowest terrace assemblage and only 4 types are so represented in the higher terrace assemblage. What is being argued here is that the higher terrace assemblage as a whole looks more like a residential camp assemblage--one where a wide range of activities were carried out by family groups--than does the composite lowest terrace assemblage. The individual lower terrace collections may well represent both residential camp and task specific camp assemblages. The fact that fewer tool classes are well represented in the composite assemblage argues for a more restricted range of activities, while the relative abundance of miscellaneous flake tools (e.g., drills, notches, and wedges) argues for a wider range of activities commonly associated with residential camps. Assuming that notched cobbles or net weights are indicative of fishing activities, the fact that they are several times more common at valley bottom than they are at valley wall sites is expected, because most fishing is thought to have occurred at the mouths of tributary streams and along the river.

Raw Materials and Reduction Technologies

Various kinds of mudstones dominate the flaked lithic artifacts recovered from the valley wall sites. Mudstones account for 71.1 percent of the tools, 76.8 percent of the cores, and 66.4 percent of the flakes and chips in this collection. In fact, mudstones represent between 62 percent and 83 percent of every tool subcategory. Most of these mudstones are available from local gravel deposits that probably served as quarries for the procurement of mudstone cobbles (representing 72.4% of all cores) to be used as cores. Some of the mudstone materials, particularly the very fine grain mudstones with conchoidal fracture patterns, may have been transported to the area from more distant bedrock quarries (cf. Choquette 1980-1981). To the extent that mudstone was brought to the area from outside sources, it must have come in the form of decorticated cores, blanks, and preforms, or completed tools, because with the exception of one core, mudstone cores with bedrock cortex are not represented in the collection. Earlier, it was noted that there is evidence for heat treatment of locally available mudstones (i.e., cores with stream worn cortex) and that heat treatment can "produce" very fine grain mudstones from coarser grain raw material. Thus, the bulk of the evidence supports the argument that locally available mudstones were used to produce most of the mudstone artifacts in the collection.

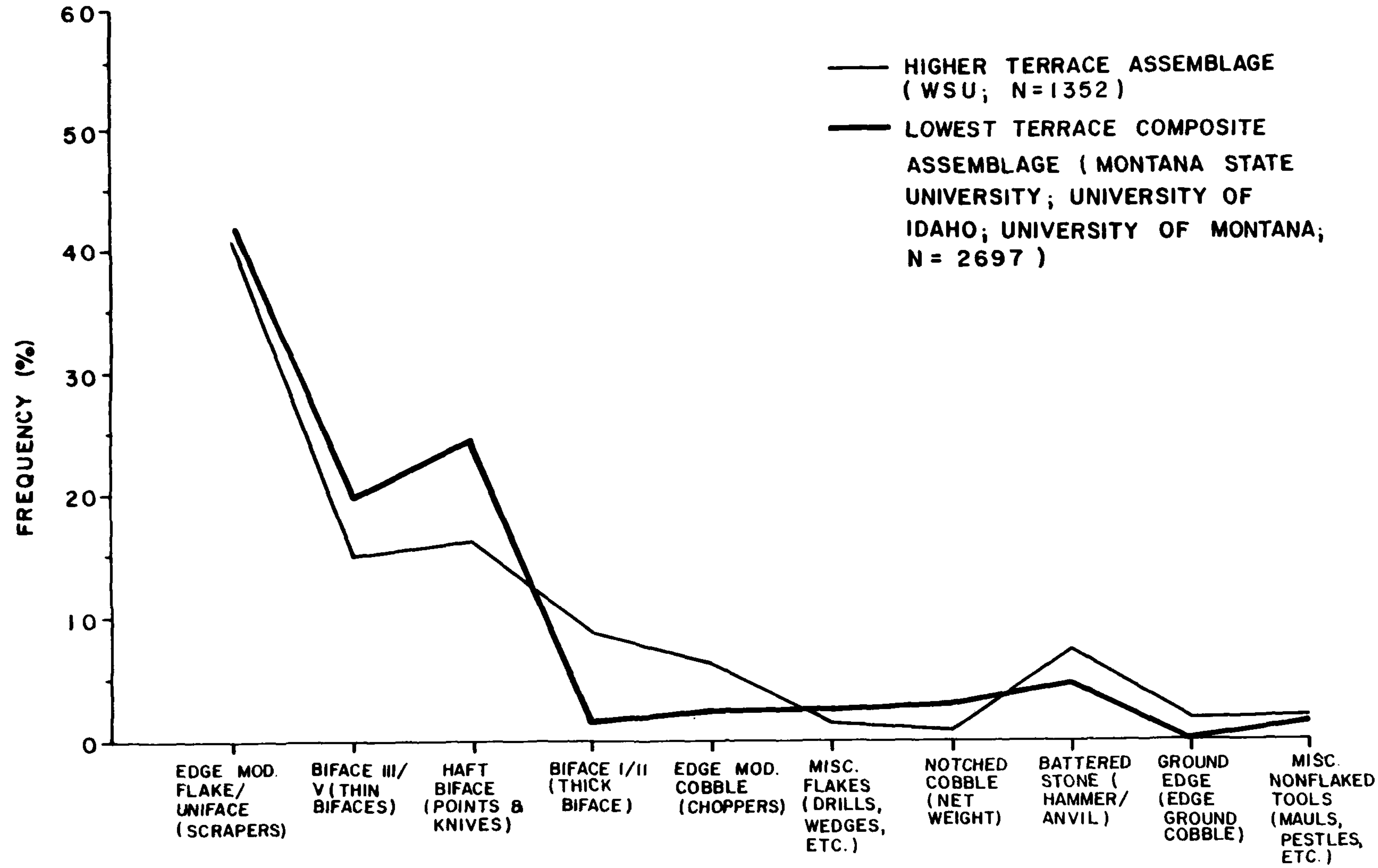


Figure 8-25. Schematic illustration of the composite lowest terrace and higher terrace lithic tool assemblage (WSU: Washington State University).

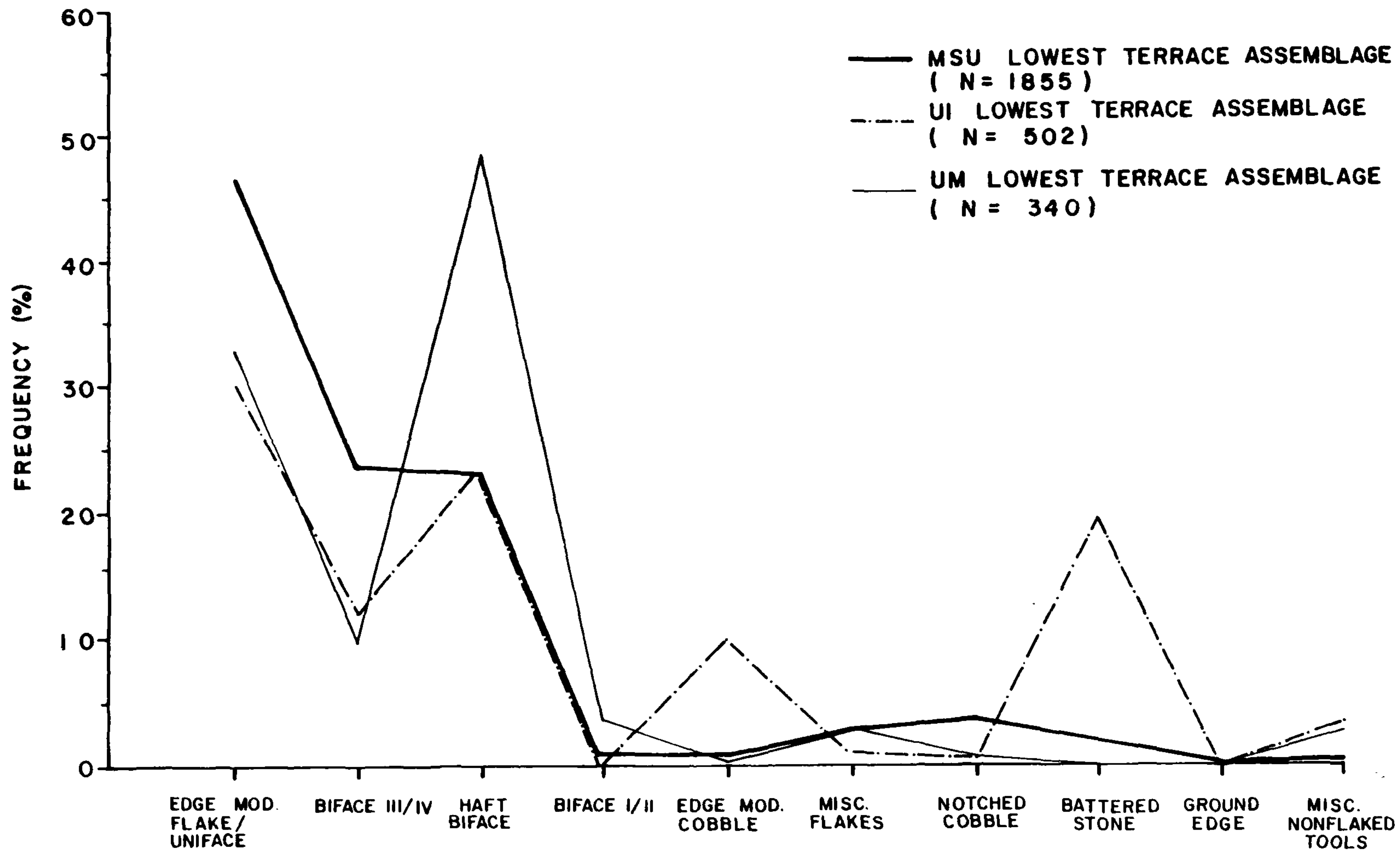


Figure 8-24. Schematic illustration of the three lowest terrace lithic tool assemblages (MSU: Montana State University; UI: University of Idaho; UM: University of Montana).

Montana State University (Roll and Smith 1982; Singleton 1982) mitigation (i.e., LAURD) project; (2) the University of Idaho survey and testing project (Rice 1979) also conducted immediately downstream from Libby Dam; and (3) the University of Montana salvage project (Taylor 1973) conducted prior to the impoundment of Lake Koocanusa. Each data set constitutes a sample of artifacts recovered from 6 to 30 sites (Figure 8-24). In several respects these three assemblages differ considerably. Differences probably are the result of several factors, including but not limited to, differential artifact recovery techniques, differing definitions for tools and other artifacts, and probably differences in the kinds of sites being sampled. Some of the differences in recovery techniques and artifact definitions can be compensated for by combining the different lowest terrace data sets to form a composite assemblage (i.e., the fourth assemblage) for the 65 sites on the lowest terraces (Table 8-15). General comparisons can then be made with the higher terrace assemblage (i.e., the fifth assemblage) that represents some 115 sites (Figure 8-25). Again, it must be stressed that comparisons of this nature permit only very general assessments of the overall differences and similarities.

Two of the five tool assemblages are distinctive in comparison to the overall trends (Figure 8-24). The University of Montana (Taylor 1973) assemblage is distinctive in that it is dominated by the haft biface (i.e., mostly projectile points) tool type. Otherwise, the assemblage does not differ greatly from the overall trends. Because projectile points are among the artifacts most likely to be collected, their dominance in the University of Montana data set may be due to sampling error. However, the relatively high frequency of haft bifaces in comparison to the lower frequency of these tools in the higher terrace assemblage is consistent with the other lower terrace assemblages. The University of Idaho (Rice 1979) assemblage differs from all others in two respects: (1) there are proportionately more edge modified cobbles (i.e., choppers); and (2) there are proportionately more battered stone artifacts that probably functioned as hammerstones and anvil stones. Interestingly, both of these tool types are large in size and might be expected to be overrepresented in survey data because they are easier to find on the surface especially along sandy and gravelly cutbanks. Nonetheless, because 46 percent of the battered stone artifacts in the University of Idaho sample were collected from three of the 30 sites and there is a high positive correlation between the number of hammerstones and anvil stones at two of those sites, the disparate nature of the assemblage could well be a measure of differential site function. Considering the exceptions already noted, the Montana State University sample (Singleton 1982) approximates the other two lowest terrace assemblages, including its low frequency of Biface I and II (thick bifaces) tools.

The higher terrace assemblage is dominated by edge modified flakes and unifaces (i.e., mostly scrapers), Biface IIIs and IVs (thin bifaces), and hafted bifaces, as is the composite lowest terrace assemblage (Figure 8-25). From a general perspective these are the kinds of tools thought to be associated with hunting related activities especially dispatching prey, cutting up meat, and scraping hides. They

Table 8-15. Summary of Selected Tool Types in the Higher Terraces Assemblage and Comparison with Lowest Terraces Assemblages.

General Tool Types	Mont. St. Univ. Lowest Terrace[1]		Univ. of Mont. Lowest Terrace[2]		Univ. of Idaho Lowest Terrace[3]		Composite Lowest Terrace[4]		Wash. St. Univ. Higher Terrace	
	N	%	N	%	N	%	N	%	N	%
Haft Bifaces (points and knives)	388	20.9	162	47.7	119	23.7	669	24.8	222	16.4
Biface I, II (thick biface)	20	1.1	12	3.5	0	0.0	32	1.2	121	8.9
Biface III, IV (thin bifaces)	429	23.1	32	9.4	62	12.3	523	19.4	202	14.9
Edge Mod. Flake/ Uniface (scrapers)	861	46.4	111	32.7	150	29.9	1,122	41.6	551[5]	40.8
Edge Mod. Cobble (uni/bifacial choppers)	13	0.7	1	0.3	50	10.0	64	2.4	85[6]	6.3
Misc. Flaked Tools (drills, notches, wedges)	48	2.6	10	2.9	4	0.8	62	2.3	17	1.3
Battered Stone (hammers and anvils)	25	1.3	0	0.0	98	19.5	123	4.6	99	7.3
Ground Edge/Edges (edge ground cobbles)	1	0.1	0	0.0	0	0.0	1	0.0	21	1.6
Misc. Nonflaked Tool (mauls, pestles, grinders)	3	0.2	10	2.9	18	3.6	31	1.1	24	1.8
Notched Cobbles (net weights)	67	3.6	2	0.6	1	0.2	70	2.6	10	0.7
TOTALS	1,855	100.0	340	100.0	502	100.0	2,697	100.0	1,352	100.0

Table 8-15. (continued)

[1]Data compiled from Singleton (1982), regulating dam, mitigation.
[2]Data compiled from Taylor (1973), Libby Reservoir, salvage.
[3]Data compiled from Rice (1979), reregulating dam, survey and testing.
[4]Data compiled by combining data from Rice (1979), Taylor (1973), and Singleton (1982).
[5]Excludes items included under miscellaneous flaked tools (i.e., 2 "drills," 6 notched flakes, 9 bipolar cores or wedges).
[6]Includes 50 "cores" with obvious use wear.

The artifacts analyzed in conjunction with this project were recovered primarily from sites located on the fourth, fifth, sixth, seventh, and eighth terraces above the modern Kootenai River. As discussed in the geology section, these terraces lie at least 20-25 m above the river channel which has been at or below its present elevation for at least 8,200 years. In other words, most of the basic landforms (excepting the first terrace) that characterize the area today were available for human occupation at least 8,000 years ago, although depositional and erosional processes continued to modify the basic landforms. Archaeological investigations in the immediate vicinity (Taylor 1973; Rice 1979; Roll 1982) have focused largely on sites located on the first and second terraces above the modern Kootenai River and to a much lesser degree on the third terrace. Differences in terrace focal points are largely the result of differing cultural resources management objectives but they provide a convenient and behaviorally meaningful way to differentiate between two kinds of assemblages.

Sites in the lowest terrace group--first, second, and third--tend to be within 20 vertical and 100 horizontal meters of the modern Kootenai River. This near-riverine or valley bottom setting provides immediate access to the Kootenai River and its resources as well as to valley bottom lands (i.e., flood basin) and their resources. Alternatively, sites in the higher terrace group--fourth through eighth and above--tend to be more than 25 m above and several hundred meters away from the Kootenai River. These sites are situated in a valley wall setting and afford ready access to resources found on the mountain slopes and flat terraces well above the river. Access to the resources of tributary streams are also facilitated. Other things being equal, one would expect that there are meaningful relationships between site locations and resource accessibility. It also would be expected that there are significant and patterned relationships between the kinds and/or relative frequencies of tools used and the different kinds and/or relative frequencies of resources exploited. It should be possible to quantify these differences by comparing the higher terrace tool assemblage (i.e., derived from this analysis) with one or more of the lower terrace tool assemblages derived by examining the information gathered during the course of previous investigations.

Different investigators routinely use different classification schemes and, in fact, define artifacts differently. These differences frequently are manifested even more when the investigations are separated temporally. However, it is possible to compensate partially for such differences by recombining various artifact groups to form general tool types. This frequently means that artifacts are forced into "pigeon holes" (Table 8-15). As a result, the comparisons and conclusions drawn from them must be considered as tentative or first approximations that are subject to modifications based on further analysis.

Three different artifact samples from lower terrace site sets have been examined and regrouped in a manner reasonably consistent with the morphological/technological analysis. Data are compiled for: (1) the

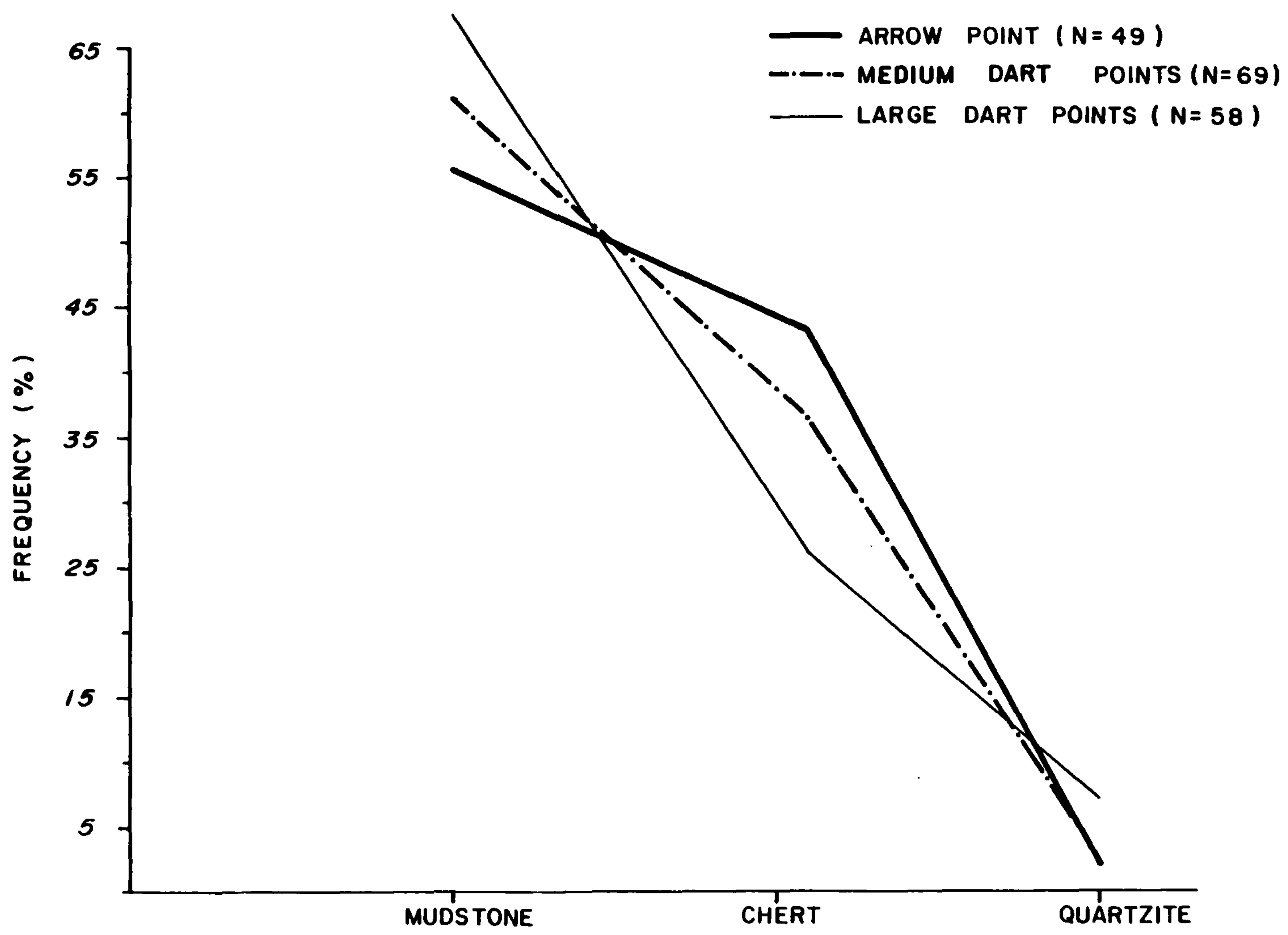


Figure 8-23. Relative frequencies of raw material types for major projectile point groups.

lowest terraces. The fact that chert materials are more workable and produce sharper edges than normally would be expected for mudstones and quartzites also explains the anomalous pattern. Recognition of the pattern that cherts are used routinely as raw material for projectile points facilitates examination of questions with chronological implications.

There appears to be a trend through time for increased utilization of chert raw materials to manufacture projectile points. This tendency can be seen in Table 8-14, which indicates that the large dart point subcategory, believed to encompass the styles characteristic of the Early and early Middle periods, contains the lowest percentage of chert points. The arrow size category contains the highest frequency of chert artifacts. Furthermore, the relative frequencies of projectile points made from mudstone and quartzite decrease somewhat through time. These relationships are illustrated in Figure 8-23. It is likely that these changes are indicative of important changes in land use patterns, both in terms of use of the project area and the larger region. Some aspects of these changes are addressed in the following paragraphs.

Summary and Discussion

In this section three kinds of information presented in the preceding sections are summarized and/or embellished. First, the lithic assemblage is characterized and compared to other tool assemblages from the immediate area. Second, comparisons are made of raw material types in conjunction with suggestions concerning lithic reduction technologies in the area. Last, projectile points in the different assemblages are compared as a means of addressing the question of general changes through time in land use patterns.

The Morphological/Technological Assemblage

The approach taken here has been to divide the group of all lithic artifacts recovered from sites on the higher terraces (i.e., the drawdown zone) into four subgroups defined on the basis of production technologies: (1) flaked; (2) nonflaked; (3) fire-cracked; and (4) unaltered. Flaked lithic tools were divided into two categories: (1) debitage or the byproducts of lithic reduction which, in turn, were subdivided into several subcategories; and (2) tools or the products of flaked lithic technologies, subdivided primarily on the basis of morphology. All nonflaked lithics were considered to be tools and divided into subcategories based on the kinds of surface modifications or technologies--battering, grinding, pecking, and incising--employed to shape the tools. Unaltered rock, herein termed furniture rock in recognition of one of its major uses, has been discussed but not subjected to detailed analysis. This also is the case for fire-cracked rock which was discussed primarily in terms of its probable functions in hearths and as boiling stones used during food preparation. The remainder of the discussion focuses on the general nature of lithic tools recovered from the Lake Koocanusa area and vicinity.

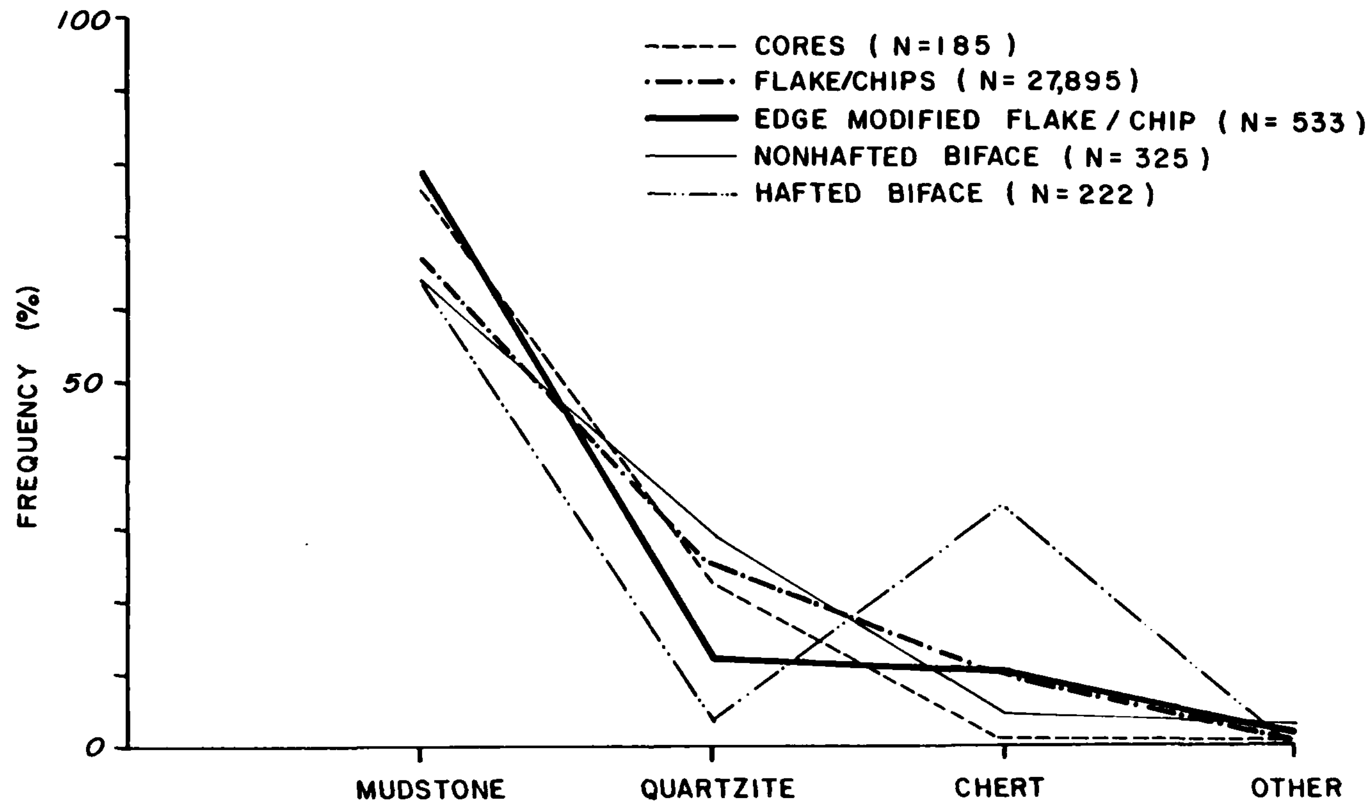


Figure 8-22. Relative frequencies of raw material types for flaked lithic tool subcategories.

as chert flakes/chips (Table 8-12). Mention has been made of the tendency for chert to be used most frequently in the manufacture of thin tools like those in the Biface IV, arrow point, dart point, end scraper uniface, and pointed end flake classes (Table 8-14). This too is an expected pattern, because chert materials tend to flake more readily and to produce sharper edges in comparison to locally available mudstones and quartzites.

The relative lack of correspondence between chert debitage and tool frequencies in comparison to those for mudstone and quartzite is explained partially by the fact that cherts are not available locally. Most, if not all of the chert, in this collection was originally brought to the sites by people, probably in the form of blanks, preforms, and large flakes, as well as finished tools produced elsewhere. Final manufacturing and reconditioning of chert tools, as opposed to the initial stages of reduction, appears to have taken place at the higher terrace sites. Were it not for information available from sites on the lowest terraces in the area (i.e., the LAURD data), one would assume that initial reduction of chert materials took place outside the project area. Chert cores and other debitage, mainly flakes and chips, occur in comparatively higher frequency (i.e., 23.2% and 65.2% respectively) at sites on the lowest terraces (Singleton 1982) and in association with projectile point styles similar to those in the moderate size dart point and arrow point classes from this collection. Because of this, it must be recognized that much of the initial manufacturing of chert tools could have occurred at the sites on the lowest terraces.

At least some of the preforms, blanks, and flakes as well as completed tools recovered from higher terrace sites probably were transported to and subsequently deposited at sites on the higher terraces. Even so, because chert tools and flakes/chips are only about three times as common as are chert cores in the LAURD collection (Singleton 1982), it is likely that blanks, preforms, large flakes, and perhaps completed tools were brought to the project area from considerable distances. This, then, would mean that artifacts indicative of the final manufacturing and reconditioning of chert tools are characteristic of the higher terrace sites in particular and of the project area in general. On the other hand, artifacts representing the entire manufacturing and reconditioning sequence for most of the mudstone and quartzite tools also are characteristic of the project area as a whole. With some exceptions (e.g., the few pumice, and sandstone artifacts), raw materials for the manufacture of nonflaked lithic tools probably were procured locally.

Examination of the major flaked lithic subcategories (i.e., those with more than 100 items) in terms of their distribution among the various raw materials (Figure 8-22) illustrates the anomalous position of haft bifaces. In comparison with other artifacts, the haft biface subcategory, comprised largely of projectile points, is overrepresented by chert. Among the other artifact subcategories, chert is always less common than quartzite. As noted, this anomalous relationship is explained partially by knowledge that chert cores as well as blanks and preforms (i.e., nonhaft bifaces) are better represented at sites on the

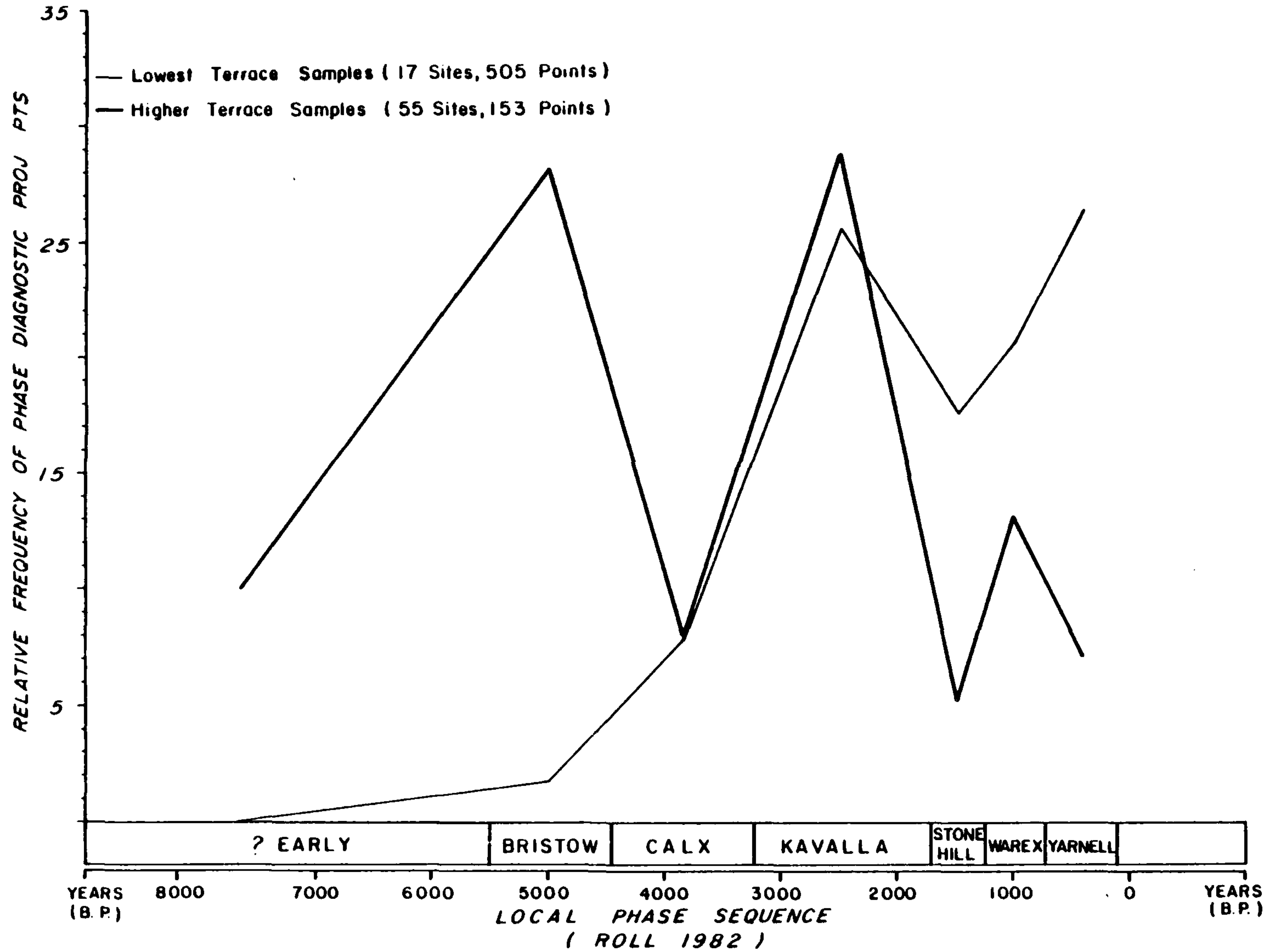


Figure 8-26. Distribution of phase diagnostic projectile point styles on higher and lowest terraces.

Figure 8-27. Bar graph comparison of the distribution of period diagnostic projectile points on higher and lowest terraces.

Morphological/Functional Analysis

The morphological/functional (morphofunctional) analysis is designed to provide the basis for a site classification scheme that is consistent with the research design. Because lithic artifacts are the most abundant and the only reasonably well preserved kind of artifactual materials in the project area, they represent the data base most likely to yield information regarding the variety of subsistence activities conducted at a site. The morphofunctional analysis represents another way of grouping artifacts. It is based on morphological factors generally related to the artifact's size and/or shape and on functional factors that denote generally how the artifacts are used. The morphofunctional analysis is directed toward distinguishing among several generalized kinds of tools judged to be indicative of broad kinds of acivities such as hunting, tool making, light-duty tasks and heavy-duty tasks. Accomplishment of that goal is facilitated by simplifying the more detailed classification scheme in such a fashion as to produce a manageable number of artifact types, each with enough items to constitute a sample of adequate size. The results of this analysis provides many of the working hypotheses employed later in the report.

Artifact classes derived as part of the morphological/technological analysis were subdivided and/or regrouped to form ten morphofunctional artifact types (Table 8-16). Reclassification was based primarily on shape, thickness, and the general nature of macroscopic wear patterns as determined by a rapid visual inspection. These are criteria usually judged to be important in grouping artifacts into functionally meaningful types. Some aspects of the morphological/technological analysis are retained. For example, the distinction between bifacial artifacts (i.e., those flaked over most of both faces) and edge modified artifacts, is maintained because manufacturing the former kind requires a greater investment in time and energy and presumably that has functional relevance. The distinction between arrow points and dart points on one hand and other hafted bifaces on the other hand also is maintained in this analysis as is the distinction between bifacially or unifacially edge modified cobbles and notched cobbles. Thickness is the primary criterion for distinguishing between tools considered to have been used for light-duty and heavy-duty tasks. Tools, at least 1.5 cm thick are considered to be heavy-duty ones in a comparative sense, and those less than 1.5 cm thick are considered to be part of the light-duty group of tools. The lack of macroscopic edge wear and/or prepared edges (i.e., flaked) on flakes/shatter and cores distinguished these kinds of debitage from flaked lithic tools which do exhibit macroscopically detectable edge damage and/or prepared edges. Nonflaked lithic tools also exhibit distinctive wear patterns (e.g., battered or ground surfaces).

Morphofunctional types

In this analysis flakes/chips and shatter are combined to form the flakes/shatter morphofunctional type. As byproducts they are representative of tool manufacturing and/or reconditioning activities. Although a detailed analysis of flakes/shatter has not been carried out, preliminary examination of these artifacts indicates that the majority

Table 8-16. Relationship Between Groups of Artifacts in the Morpho-functional Analysis and the Morpho/Technological Analysis.

Morpho-functional Type	Morpho/Technological Constituents (No.)	Number of Specimens
Flakes/Shatter	Flakes/Chips (29,156); Shatter (1,567)	30,723
Cores	Biface I (19); Biface II (27); Cobble Cores (22); Split Cobble Cores (10); Partial Cobble Cores (61); Decorticated Cores (33); Bipolar Cores (9)	181
Thick Bifaces	Biface I (10); Biface II (65)	75
Thin Bifaces	Biface III (166); Biface IV (38); Other Hafted Biface (12); Undetermined Hafted Biface (5)	221
Arrow Points	Small Size Haft Biface (49); Indeterminate Size Projectile Points (2)	51
Dart Points	Moderate Size Haft Biface (69); Large Size Haft Biface (58); Haft Biface Blade Fragment (27)	154
Thin Edge Modified Tools	Unifaces (13); Edge Modified Cobble Unifacial (7); Edge Modified Flake (471): Endscraper (51), Alternate Faces (20), Opposing Margins (54), Notched (4), Pointed End (37), Tabular Pieces (16), Bifacial (11), Unifacial (278)	491
Thick Edge Modified Tools	Cores (50): Cobble (12), Split Cobble (15), Bipolar (1), Partial Cobble (14), Decorticated (8) Edge Modified Cobbles: Bifacial (11), Unifacial (17) Edge Modified Flakes (62): Endscraper (2), Notched (2), Opposing Margins (1), Alternate Faces (1), Bifacial (5), Tabular (2), Unifacial (49), Unifaces (11)	151
Net Weights	Edge Modified Cobbles Notched (10)	10
Nonflaked Lithic Tools	Battered Stone (99); Grained Stone (34); Pecked Stone (9); Incised Stone (2)	144
TOTALS		32,201

of them are representative of biface thinning and resharpening processes. Stated differently, most of the flakes/shatter are indicative of the latter stages of tool manufacturing processes, including the reconditioning of finished tools. A smaller but quite significant proportion of the flakes are representative of core reduction or the initial stages of tool manufacture. Cores--flaked lithic nuclei without obvious edge damage or prepared edges--also are viewed as evidence for initial lithic reduction. Flakes/shatter (30,723 items) and cores (181 items) constitute 95.4 percent of the 32,201 flaked and nonflaked artifacts. The 1,478 items in the tools-plus-core group represent 4.6 percent of the flaked and nonflaked lithic artifacts. The tools-plus-core group is the focus of this analysis (Table 8-17).

Thick bifaces (i.e., 1.5 cm or greater in thickness) as a morphofunctional type, are bifacially flaked artifacts that tend to exhibit obvious wear in the form of dull, crushed, sinuous edges. These tools (75 or 5.1% of the 1,478) appear to have been used for heavy-duty chopping and cutting on relatively hard materials such as bone or wood. Thin bifaces (i.e., less than 1.5 cm thick) have straighter edges, which may exhibit use wear, in the form of dull, rounded edges or tiny flake scars, but crushed edges are unusual. They are among the more common tools (221 or 15%), and probably tended to be used for comparatively light-duty tasks, such as cutting, scraping, drilling; others may be preforms. Most investigators agree that thin bifaces tend to function like knives, but were used in a variety of ways usually associated with processing game animals. Two basic kinds of projectile points--arrow (51 or 3.5%) and dart (154 or 10.4%)--are distinguished and considered to be indicative of hunting activities. Light-duty cutting, scraping and drilling also are probable uses for projectile points. In general, thin bifaces and projectile points are the kinds of tools that one would expect to be curated because they are often made from nonlocal (i.e., rare) raw materials, they require an investment in time and energy to manufacture, and they can be reconditioned and reused many times over. The abundance of these items (representing 33.8% of the morphofunctional sample) and the fact that they are found in an area considered to have abundant game resources, argues strongly for the importance of hunting in the subsistence systems.

Thin edge modified tools are the most common (491 or 32.2%) morphofunctional type. In comparison to bifaces and projectile points, thin edge modified tools require relatively little investment in time and energy to manufacture. They probably represent a wide range of single and multipurpose expediency tools (i.e., tending to be made, used, and discarded on-the-spot) that are expected to occur in high frequencies. Items in this morphofunctional type include, but are not limited to, those traditionally termed side scrapers, end scrapers, spokeshaves, and utilized flakes. Their sizes and shapes suggest that they were used for relatively light-duty work on bone, wood, meat, and hides. Many of these items, especially those classed as end scrapers, exhibit extensively worn (i.e., well rounded and smooth) edges suggesting use on soft materials. Thick edge modified tools (i.e., 1.5 cm or greater in thickness) represent 10.8 percent (151 items) of the

Table 8-17. Summary Data for the Morphofunctional Artifact Analysis.

Morpho-functional type	Number of Specimens	Percent of All Types	No. of Sites Represented	Raw Material Types							
				Mudstone		Cherts		Quartzite		Other	
				No.	%	No.	%	No.	%	No.	%
Cores	181	12.2	28	120	66.3	1	0.6	58	32.0	2	1.1
Thick Bifaces	75	5.1	26	49	65.3	0	0.0	23	30.7	3	4.0
Thin Bifaces	221	15.0	41	156	70.6	17	7.7	44	19.9	4	1.8
Arrow Points	51	3.5	26	29	56.8	21	41.2	1	2.0	0	0.0
Dart Points	154	10.4	43	97	63.0	49	31.8	8	5.2	0	0.0
Thin Edge Modified Tools	491	33.2	63	391	79.6	55	11.2	40	8.2	5	1.0
Thick Edge Modified Tools	151	10.2	33	108	71.5	0	0.0	42	27.8	1	0.7
Net Weights	10	0.7	8	9	90.0	0	0.0	0	0.0	1	10.0
Nonflaked Lithic Tools	144	9.7	42	32	22.2	0	0.0	50	34.7	62	43.1
TOTALS	1,478	100.0	109	991	67.0	143	9.7	266	18.0	78	5.3

sample and are considered to have been used for heavy-duty tasks. These are the kinds of items often called large scraper-planes, adzes, and choppers. They may have been used during initial butchering or bone processing activities, as well as for wood working and perhaps for other tasks related to processing vegetal materials. In general, the edges on these tools appear to be crushed as evidenced by the presence of many step fractures. However, some of the thick edge modified tools have smoother edges suggesting use on relatively soft materials.

Net weights are the bilaterally notched, disc-shaped artifacts widely thought to have been attached to fishing nets. The occurrence of several burned fish bones and a net weight at 24LN427 provides some support for the idea that net weights are indicative of fishing. Net weights are the least common kind of morphofunctional tool, representing only 0.7 percent (10 items) of the collection.

Nonflaked lithic tools--battered, ground, pecked, and incised stone--constitute 9.7 percent (144 items) of the sample. Tools of this type tend to be large and heavy; they are considered to be associated with heavy-duty tasks of various kinds. These items appear to be hammerstones, anvil stones (battered), grinding stones or manos and edge-ground cobbles and slabs (ground), mauls, pestles, and shaft abraders (pecked) as well as items with undetermined uses (incised). Two of the more probable uses of battered stone tools (99 or 6.7% of the 1,478 items)--hammerstones and anvil stones--are for manufacturing stone tools and crushing bone. It is also possible that they were used for working wood or other vegetal material. Grinding slabs, manos, edge-ground cobbles and pestles, and perhaps mauls are considered generally to be indicative of processing vegetal foods or for wood working in the case of mauls. However, there is ethnographic evidence to suggest that edge-ground cobbles may have been used to soften and/or to dehair hides (Ewers 1958:110; Swanson 1972:88, 97-99). There also is ethnographic evidence indicating that grinding slabs, manos, pestles, and mauls were used to pulverize dried meats as well as to process roots and berries (Smith 1984). The point here is to recognize that nonflaked lithic tools, particularly ground and pecked stone, probably functioned as part of a hunting (e.g., meat processing) assemblage and a gathering (i.e., vegetal processing) assemblage. As is argued elsewhere in this report, worldwide hunter-gatherer data strongly attest to the overwhelming dominance of game animals in the diets of groups living in northern, boreal forest regions (Murdock 1967). Thus, it should not be surprising that nonflaked lithic tools might be important items in hunters' tool kits.

Discussion

Results of the morphological/functional analysis permit characterization of the overall assemblage in a number of ways that are directly applicable to the issues raised in the research design. The basic model stipulates that small groups of highly mobile big game hunters would be characteristic of the area and that through time group size would increase, residential mobility would decrease and a greater

range of food sources (e.g., small size game, fish and vegetal resources) would be exploited regularly. Data generated here tend to support those basic contentions.

Overall, the collection is dominated (43.5%) by edge modified artifacts. These are, in effect, expediency tools used and discarded regularly; they are among the kinds of tools one would expect to be represented best among highly mobile groups. They would be expected to accumulate rapidly at residential sites and at some kinds of special activity sites. However, if most sites on the higher terraces are representive of short-term residential camps, there should be considerable variety in the assemblage. This too is apparent. With the exception of net weights, all other morphofunctional types are represented by relative frequencies of at least 3.5 percent, and six of the nine types occur in frequencies of approximately 10 percent or higher. There also is good evidence that hunting and related activities dominated the subsistence system. Projectile points and thin bifaces or knives are the kinds of artifacts most clearly associated with hunting. Those artifact types account for almost 30 percent of the assemblage. That is a great deal more than any other combination of tool types that are accepted widely as representing other subsistence related activities such as fishing or gathering/processing vegetal resources.

A wide range of tool types also is characteristic of most large intrasite assemblages. For example, relative frequencies of morphofunctional types at 24LN1054 closely parallel the combined frequencies for all other sites and for the entire sample, including 24LN1054 (Figure 8-28). In fact, even for the sites with much smaller samples the frequency distributions are similar to the overall pattern. The issue of sample size is an important one, because of the general tendency for diversity to increase significantly as the number of items in the sample increases (Jones, et al. 1983). Although, the relationship between sample size and diversity has not been examined in detail here, it appears that sites with representative collections are reasonably similar in terms of their frequency distributions, whether they have 11-20, 21-30, 31-66 or more than 100 tools (Figure 8-29).

According to the general model, it is expected that diversity in tool types would decrease through time, if there was an increase in the number of special activity sites and a decrease in the number of residential sites on the higher terraces. This suggestion can be examined by comparing the frequencies of tool types at single component sites (Figure 8-30), that is occupied during one as opposed to two or more periods. Results are as predicted. The assemblage representing early Middle Period sites is characterized by seven tool types, each represented in roughly similar frequencies, and the Late Prehistoric assemblage exhibits less diversity and a greater range in tool type frequencies. The late Middle assemblage is intermediate. Thus, there are clearly several lines of evidence lending credence to the contentions that residential mobility decreased through time and the higher terraces tended to become the focus of task specific activities, mainly those related to hunting. This argument is made because well represented, diverse artifact types are indicative of a residential camp

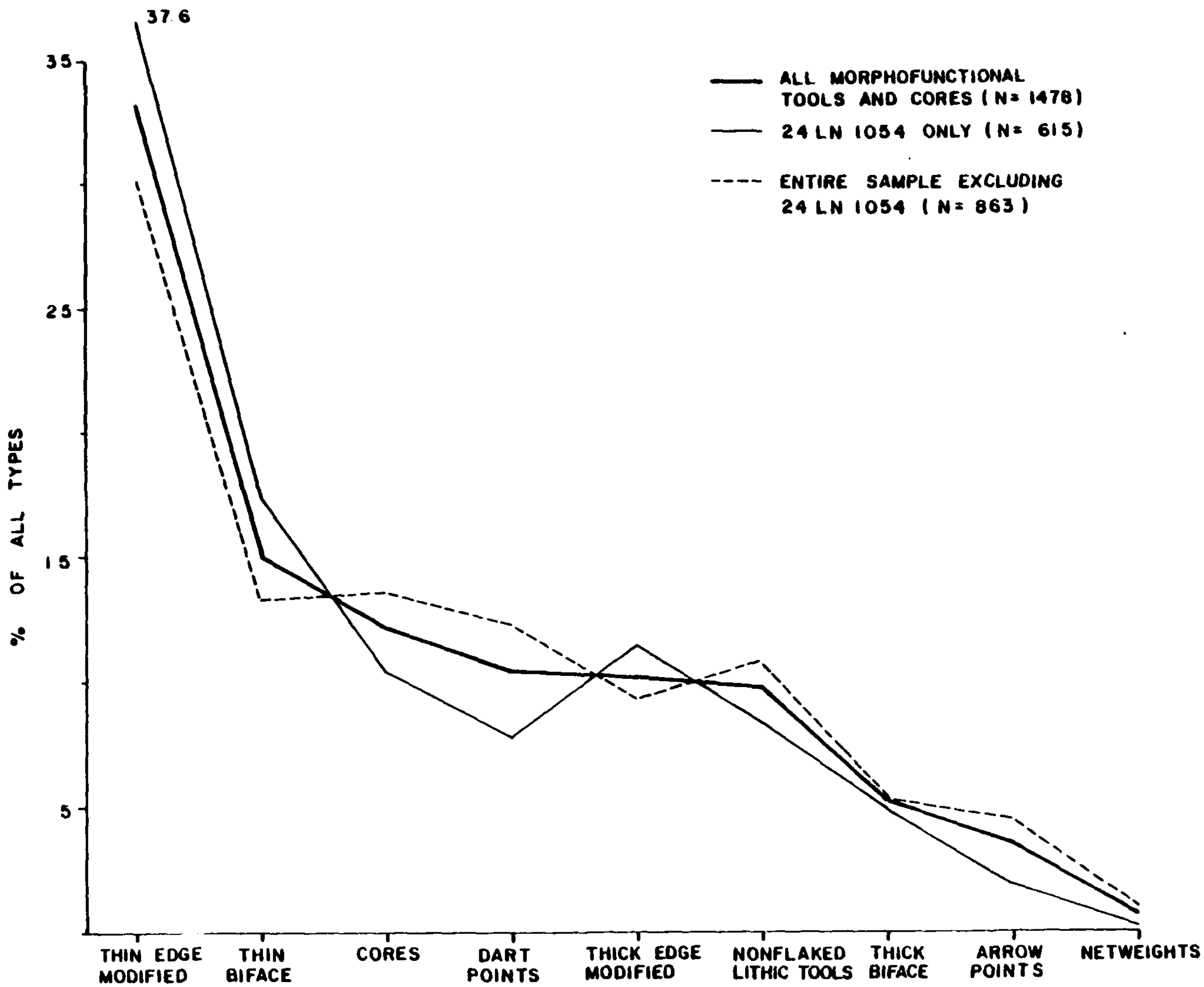


Figure 8-28. Comparison of relative frequencies of morphofunctional types in a large intrasite assemblage with the overall sample.

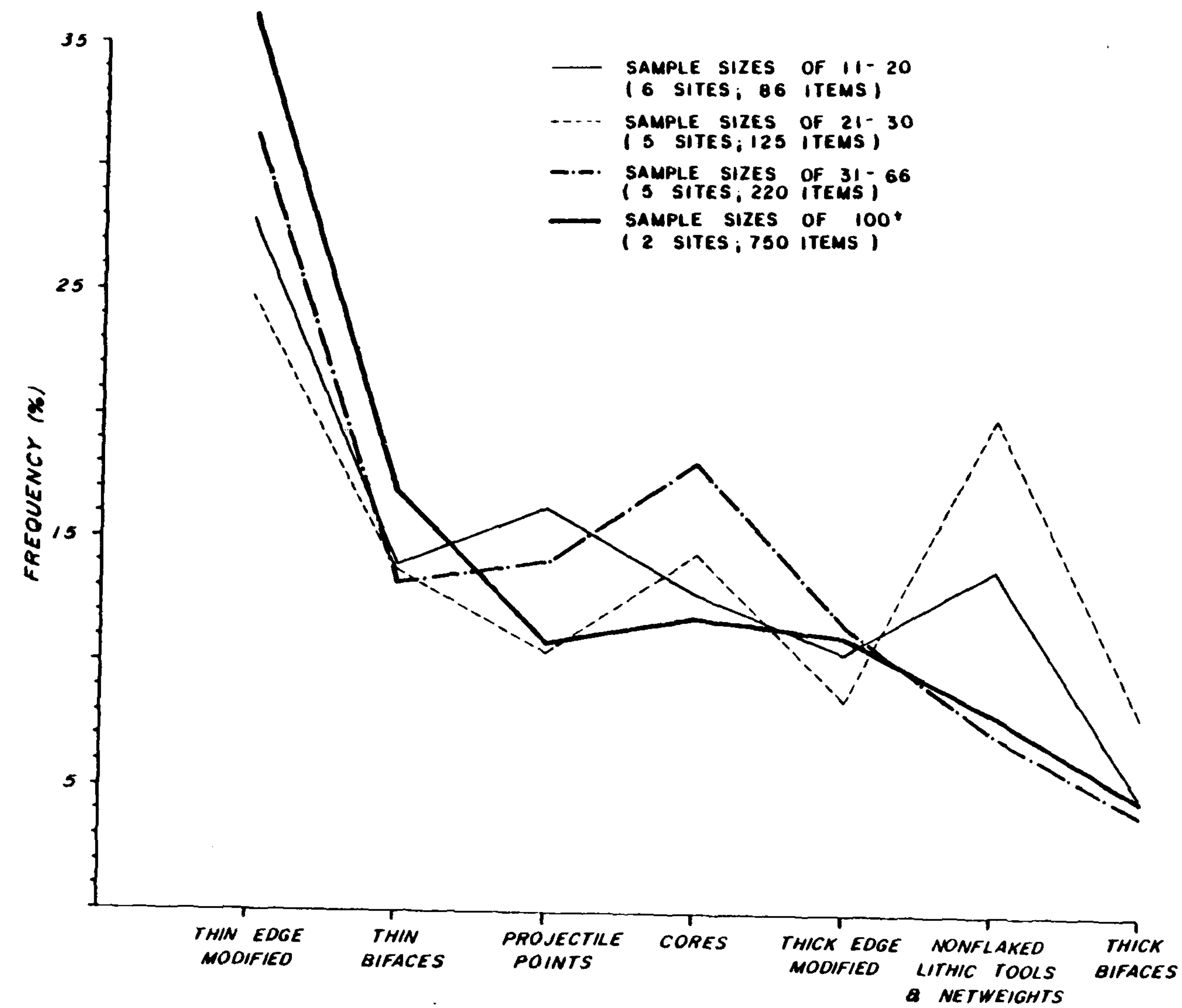


Figure 8-29. Comparisons of relative frequencies of morphofunctional tool types at sites with different sample sizes.

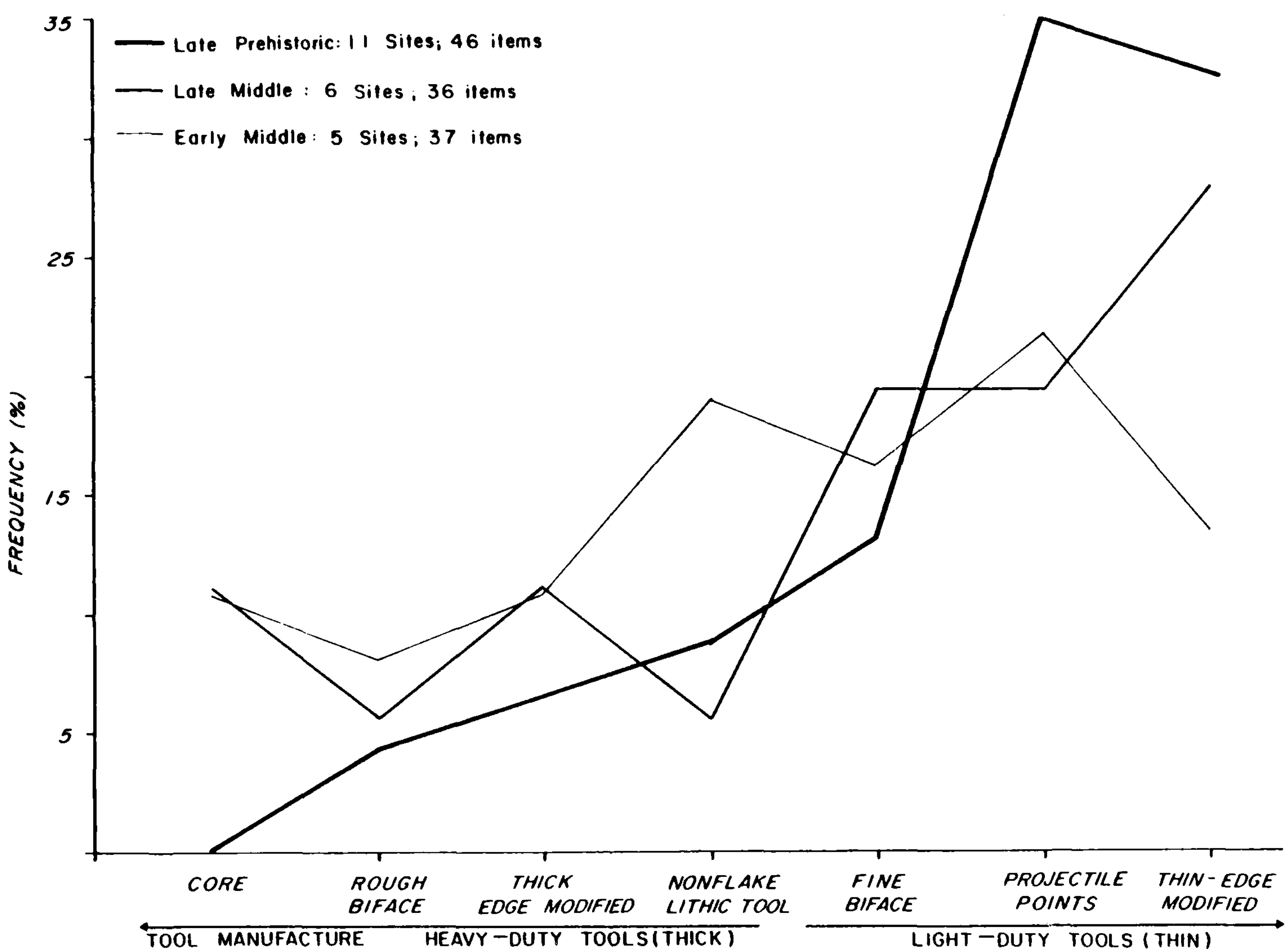


Figure 8-30. Frequencies of core/tool classes for the single component sites.

assemblage and the early Middle Period sites best illustrate these characteristics. Alternatively, sites with fewer kinds of tools, especially sites clearly dominated by one or two tool types, are likely to be special purpose sites occupied by some, but not all family members. That kind of special purpose camp assemblage is most characteristic of the Late Prehistoric Period sites.

CHAPTER 9

FAUNAL ANALYSIS

by
Deborah L. Olson

A total of 4,360 faunal remains (bone and shell) was recovered from the project area, 1,336 from 26 sites in 1981 and 3,022 from 57 sites in 1982. The methods and descriptive results of the analysis are discussed in this chapter, as are the problems entailed in conducting the analysis and the research results in relation to the land use model. Descriptive information is presented in tabular form by site (in numerical order) in Appendix E.

Methods

The first stage and basis of all subsequent analysis is the identification of the faunal remains. Identification encompasses the recognition and recording of several variables above and beyond taxonomic designation. Since this stage of analysis influences all subsequent work, it is essential that the method of identification be explicitly defined. This entails defining what is identifiable and unidentifiable, and an explanation of the variables being considered. The first step in any identification is the separation of identifiable remains from those considered unidentifiable using methods employed in this project (i.e., the unidentified remains). This separation cannot be assumed to be the same for different researchers. The definition used here is that a bone/bone fragment is considered identifiable if it can be assigned: (1) to a skeletal element; (2) to at least class taxonomic level; and (3) to a generalized size class for mammal remains.

For this analysis eight variables were used in the identification of each bone and bone fragment: taxon, skeletal element, portion of skeletal element, side, fragment size, modifications, number, and weight. Additional information on the general condition of the bone (e.g., recently deposited "new" bone, articulations, tooth wear, epiphyseal union and pathologies) also was recorded when possible. Each variable is defined and discussed below.

Taxon

This variable includes Linnaean taxonomic identification to the most specific level possible. However, for the majority of the remains recovered this is only to class (e.g., mammal, fish). To maximize the identified portion of the sample, generalized size classes based on the weight ranges and corresponding body sizes of living animals are used

(Uerpmann 1973; Ziegler 1973). There is some overlap in weight ranges but this is minimal and usually occurs in the extremes of size (e.g., a small whitetail deer 22.5 kg and a large beaver 27 kg). The four generalized size classes are applied only to mammal remains and are defined as follows (Olson 1983):

Large: includes large ungulates (i.e., Bos, Bison, Equus, Alces, and Cervus) that range in weight from 900 kg (a large male bison) to 225 kg (a small female elk).

Medium: includes small ungulates (i.e., Ovis, Odocoileus, Oreamnos, and Rangifer) and large carnivores (i.e., Ursus, Canis lupus, and Felis concolor) that range in weight from 382 kg (a large grizzly bear) or 270 kg (a large male caribou) to 22.5 kg (a small, female whitetail deer).

Small: includes carnivores (i.e., Canis, Lynx, Lutra and Procyon), large rodents (i.e., Castor, Marmota, Erethizon, Ondatra) and rabbits that range in weight from 27 kg (a large beaver) to 0.7 kg (a small cottontail or marten).

Very Small: includes all shrews, most rodents, and small carnivores (i.e., weasels) that are less than 0.7 kg in weight.

In addition to these four size classes the designation medium/large is used for fragments that appear to be artiodactyla but are broken in such a manner as to preclude identification to large or medium size classes.

Skeletal Element

This variable is the correct anatomical name (e.g., femur, metatarsal, mandible) for the bone represented. Where it is not possible to identify the element, the bone is identified as cancellous (i.e., the kind found in articulating ends of long bone and vertebrae), or noncancellous (i.e., the more compact bone, like the mid-section of a longbone).

Portion of Skeletal Element

This variable describes which part (e.g., distal, lateral, proximal) of the bone is present or whether the bone is complete and is useful in discerning butchering practices, etc.

Side

This variable indicates which side of the body a bone comes from when such a distinction is possible to make. Side is useful in calculating minimum number of individuals (MNI) and patterns of distribution.

but all of these appear to be intrusive. The remaining 39 deer bones are post-cranial skeletal elements for the most part. Of these deer remains, 27 from 13 sites are considered to be archaeological. Two deer bones from 24LN686 and an isolated concentration of bones across the river from 24LN392 are of questionable association. The deer bone from 24LN1055 is intrusive, even though it has cut marks in the acetabulum for disarticulating the hind limb. The animal probably was dispatched and butchered recently.

The largest portion of the faunal remains recovered from the project area has been identified only to generalized size classes, (Table 9-4). The relative frequencies of the size classes only and the size classes with the identified portion are very close although the frequencies with the identified remains are slightly lower. The very small mammals are all considered to be intrusive and are most likely rodent remains. The small size mammals are the next smallest sample (7.6% of the identified to size class group) and all but two of these bones are archaeological. The medium size mammals constitute the largest sample (51.7%). Most are probably deer, since deer constitute most of the identified medium mammals. All but 29 are considered to be archaeological. These 29 bones consist of immature/fetal individuals (i.e., poorly preserved bones that appear to be of recent deposition). All but eleven of the large size mammals are archaeological. The medium/large size mammal remains are the second largest sample (27.1%) and are all considered to be archaeological.

To summarize, the faunal remains from the project area have been divided into four samples: the nonmammalian remains, the unidentified mammalian remains, the identified (to at least family) mammalian remains, and the mammalian remains identified to general size class. Each is assessed as to temporal association with other archaeological remains. Only 12 or 7.2 percent of the nonmammalian remains (including the four exotic shell fragments/artifacts) are archaeological. All of the unidentified remains are archaeological. A little less than half of the identified mammalian remains, (116 or 48.5%, representing 14 taxa are archaeological, including the three antler tine tools) and the majority of the mammalian remains identified to size classes (2,693 or 97.3%) are archaeological. Only the very small mammals are classed as intrusive.

Discussion and Conclusions

The project area is rich in ungulate and other animal resources utilized by humans. The potential ungulate resources include elk, two species of deer (mule and whitetail), moose, caribou, bighorn sheep, and bison. All of these species with the exception of moose are present in the recovered faunal remains and in the archaeological fauna. However, the identified remains account for only 5.6 percent of the total sample and only 2.7 percent of the total sample are identified archaeological faunal remains. To a large extent, this reflects preservation conditions in the project area.

intrusive or archaeological, depending on the age of the site. All the horse remains appear to be of considerable age (some degree of mineral replacement) and some may have been buried for some of time. Most of the cow (Bos), and indeterminate Bos/Bison remains are of recent origin and probably are nonarchaeological. The exceptions are mostly indeterminate Bos/Bison (3), and at 24LN427 two Bos bones (one sawed) belong to the historic component of the site. A single first phalanx from 24LN666 appears to be bison. This identification seems to be reasonable because bison are documented in the historical record (Smith 1984).

The eight Ovis remains are probably mountain sheep and only two are considered to be archaeological. The remains from Feature 1 at 24LN700 present special problems. The two Ovis and 12 medium size remains may represent a single skeletal element (tibia) which was broken while still green, then exposed to a low intensity fire (possibly a grass or forest fire). The problem is whether this feature is contemporaneous with the other archaeological remains, at the site but for the purpose of this discussion, Feature 1 will be considered as archaeological.

All the remaining identified remains belong to the Cervidae (deer) family, including three bone tools made on antler tines. The only faunal remains from 24LN193 available for this analysis is an antler tine tool collected by Roll and Bailey (1979). This tine is a possible flaking tool; the tip has been deliberately modified (sharpened by cutting) and has been faceted and polished by use. The distal (or basal) end of the antler has been gnawed heavily by rodents and dogs, and there is some overall tooth scaring (dog). The tool measures 91.2 mm in length and 15.05/1.5 mm in width/thickness at the base and 3.0/4.05 mm at the tip. Another antler tine tool is from 24LN364 and could be a flaking tool, arrow shaft straightner, or thatching tool. The distal end of the tine has been deliberately modified to produce a hole through the tine (i.e., an eye) which appears to have been compressed or flattened by subsequent gnawing which also cracked/split the distal end of the tool. The eye measures 18.45 mm long and 7.75 mm wide. The tip of the tine is faceted and polished from use. The entire tine has been root etched and gnawed by carnivores. It measures 229.0 mm in length and 22.2 mm wide at the base and 3.0 mm at the tip. The third antler tine tool is an isolated find (I.A. 12) that may be a flaking tool. The tip is faceted and polished from use. The distal end has been extensively gnawed by rodents and dogs, and the entire tool is weathered. The tine measures 102.7 mm in length and 28.35/16.44 mm in width/thickness at the base and 3.1 mm at the tip. These three tools are illustrated in Figure 9-1.

The remaining seven Cervidae antler fragments are all archaeological, but the antler fragments identified to genus (two elk and one deer) are of recent deposition. A single element has been tentatively identified as Rangifer (caribou from 24LN700) it appears to have been buried and is therefore considered to be archaeological. Of the 10 elk bones (two are antler fragments), eight (from three sites) are considered to be archaeological. Ten deer bones (maxillas and mandibles) from five sites have been identified to the species level,

A small portion of the mammal remains, 239 or 5.5 percent of the entire sample, has been identified to family, genus, and species. Identified taxa are summarized in Table 9-2. Assessment of temporal association is critical and especially difficult for this sample for numerous reasons. Taphonomic studies indicate that in all environmental settings, bone weathers substantially (i.e., becomes unidentified) in as little as 30 years. Most of the identifiable bone material from the project area has been weathered to some extent but whether this is due to recent deposition or recent reexposure is unknown. Therefore, determinations of temporal association employ as many lines of evidence as possible. These determinations are listed by site in Table 9-3. Included in Table 9-3 are remains whose determinations of temporally association are questionable and depend on site age since other evidence (e.g., modification, degree of weathering, and mineralization) indicate that they are nonintrusive. For example, if site 24LN674 is historic aboriginal then the horse remains are temporally associated.

Most of the identified rodent remains and all of the very small size mammals are intrusive. But of the three specimens identified as Onychomys (mice), two have been burned white. Both specimens are surface finds and the burning may be the result of forest fire.

Seven taxa of small size mammals have been identified in the faunal sample. Although two specimens have been identified tentatively as wolf (Canis lupus) which is a medium size mammal, they are included with the other canids in this discussion. Most (53) of these identified small mammals are rabbits, and 49 of these rabbit remains are considered to be archaeological because of burning, breakage patterns, and skeletal elements represented. On the other hand, the four identified Lepus remains from 24LN386 (1), 24LN665 (1), and 24LN1073 (2) appear to be recent or intrusive. The next most numerous identified small mammals are the dog (22), but unlike the rabbit remains, most of these are nonarchaeological. The only faunal items collected from 24LN375, the skull of a wolf, is intrusive, but the burned distal phalanx of a wolf from 24LN1054 is considered to be archaeological. Eleven dog bones forming an articulated left ankle with sinew still present (recent deposition) came from 24LN386, along with a burned distal phalanx (archaeological). The Canis bones from 24LN677 (5, all one individual) and 24LN685 (1) are nonarchaeological, but the distal phalanx from 24LN1058 is considered to be archaeological. The remaining three identified small mammals (Marmota, Felidae, and Mustelidae) are intrusive.

The majority (140) of the identified remains are medium and large size mammals and all are ungulates with the exception of a single element identified as bear Ursus, from 24LN672. This bone appears to be nonarchaeological although it looks older than the other bones at the site. Other identified taxa include three of historic origin, horse, cow, and domestic sheep. The two possible domestic sheep from two sites and were identified based on size. These bones are from immature individuals and are considered to be intrusive, although the bone from 24LN696 appears to represent an older depositional episode. The six horse bones were collected from five sites. These bones could be either

Table 9-3. (Continued)

Site (24LN....)	Taxon	Skeletal Element
1074	Leporidae	Long bone shaft fragments (3)
1076	*Equus caballus**	Right metatarsal
1087	*Sylvilagus nuttalli*	Right proximal ulna
	Leporidae	Rib fragment (1)
	Cervidae	Antler fragments (2)
1144	*Canis familiaris*	Left humerus (cut marks)

Table 9-3. (Continued)

Site (24LN....)	Taxon	Skeletal Element
656 (Cont.)	Odocoileus sp.	Left femur
	Odocoileus sp.	Distal metatarsal (cut marks)
	Odocoileus sp.	Last rib (cut marks)
657	Odocoileus sp.	Right calcaneum
660	Bos* sp.	Left proximal metacarpal
661	Bos/Bison*	Left medial cuniform
663	Bos taurus*	Distal metacarpal and shaft
666	Bison(?)	First phalanx
667	Equus caballus*	Left distal tibia and shaft
674	Equus caballus*	Right central tarsal
	Equus caballus*	First phalanx
677 Feature 1	Odocoileus sp.	Molar (newly erupted)
	Odocoileus sp.	Mandible fragment
686	Odocoileus sp.*	Left radius
691	Odocoileus sp.	Right distal femur
	Equus caballus*	Right radius
696	Odocoileus sp.	Right distal tibia
	Odocoileus sp.	Left metatarsal
700	Rangifer caribou	Right maxilla
	Ovis sp.*	Left proximal tibia
	Ovis sp.*	Left distal tibia
701	Equus caballus*	Premolar
711	Odocoileus sp.	Right proximal metatarsal
1054	Leporidae	Rib fragment (1)
	Leporidae	Long bone shaft fragment (40)
	Canis lupus	Distal phalanx
	Cervidae	Antler fragments (2)
	Ovis sp.	Left metacarpal
1058	Canis sp.	Distal phalanx
1073	Leporidae	Long bone shaft fragment
	Cervus canadensis	Right radius
	Cervus canadensis	Right femur
	Cervus canadensis	First phalanx

Table 9-3. Summary of the Temporally Associated Identified Mammalian Remains (*denotes questionable determinations that depend on site age).

Site (24LN....)	Taxon	Skeletal Element
Isolated Artifact	Cervidae	Antler tine tool
193	Cervidae	Antler tine tool
364	Cervidae	Antler tine tool
366	Cervus canadensis	Molar (well worn)
	Odocoileus sp.	Left proximal metatarsal (cut marks)
	Odocoileus sp.	Left naviculo-cuboid
	Odocoileus sp.	Second phalanx
386	Canis sp.	Distal phalanx
	Ovis sp.	Right calcaneum
388	Odocoileus sp.	Right metatarsal
392	Cervus canadensis	Distal metatarsal
	Cervus canadensis	Proximal metatarsal
	Cervus canadensis	Distal metacarpal
	Cervus canadensis	Thoracic vertebra (cut marks)
Across from 392	Odocoileus sp.*	Distal metacarpal
402	Cervidae	Antler fragment (2)
418	Cervidae	Antler fragment
423	Odocoileus sp.	Premolar
427	Odocoileus sp.	Right distal humerus (sawed)
	Bos taurus	Right blade of illium (sawed)
	Bos/Bison	Right astraglus
429	Leporidae	Long bone shaft fragment
	Leporidae	Atlas vertebra fragment
	Odocoileus sp.	Right distal fibula
443	Odocoileus sp.	Right radial carpal fragment
656	Odocoileus sp.	Right innominate (2)
	Odocoileus sp.	Left innominate (2)
	Odocoileus sp.	Left illium
	Odocoileus sp.	Thoracic vertebra
	Odocoileus sp.	Lumbar vertebra
	Odocoileus sp.	Sacrum
	Odocoileus sp.	Right distal humerus

Table 9-2. Summary of the Mammal Faunal Remains from the Project Area Identified to at Least the Family Level.

Taxon	Common Name	Number
Onychomys leucogaster	Northern grasshopper mouse	3
Thomomys talpoides	Northern pocket gopher	2
Sciurus sp.	Squirrel	3
Marmota sp.	Marmot	1
Geomyidae	Pocket gopher family	9
Sciuridae	Squirrel family	1
Microtinae	Vole subfamily	1
Sylvilagus nuttalli	Mountain cottontail	1
Lepus sp.	Hare/jackrabbit	4
Leporidae	Rabbit and hare family	48
Canis familiaris	Domestic dog	1
Canis lupus*	Wolf	2
Canis sp.	Dog	19
Ursus americanus	Black bear	1
Felidae	Cat family	1
Mustelidae	Mustelid family	2
Equus caballus	Horse	6
Cervus canadensis	Elk	12
Rangifer caribou	Caribou	1
Odocoileus hemionus	Mule deer	6
Odocoileus virginianus	Whitetail deer	4
Odocoileus sp.	Deer	39
Cervidae	Deer family	10
Ovis aries	Domestic sheep	2
Ovis sp.	Sheep	8
Bos taurus	Cow	5
Bos sp.	Cow	35
Bos/Bison	Cow or bison	12
TOTAL		239

*This identification is tentative, specimens could be very large variety of domestic dog (e.g., large german shepard).

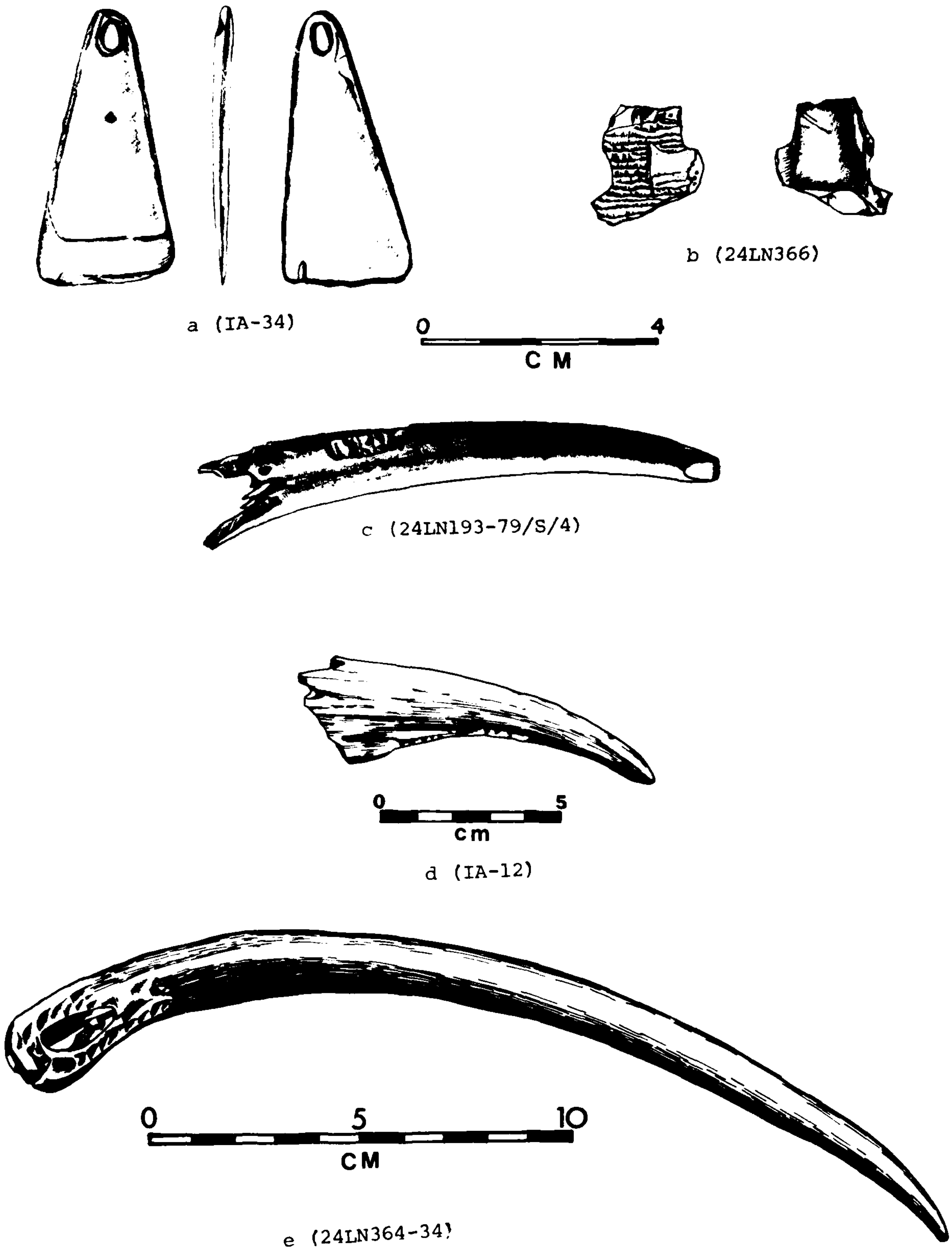


Figure 9-1. Bone and shell artifacts: (a) shell pendant IA-34; (b) abalone 24LN366; (c) antler tine 24LN193; (d) antler tine IA-12; (e) antler tine 24LN364.

fragments from two sites, 24LN427 and 24LN1054, are considered to be archaeological. Four pieces of exotic shell material were collected in the project area, three abalone fragments from 24LN366 and a shell pendant (Isolated Artifact 34). The three abalone fragments from 24LN366 are temporally associated with the archaeological remains. Two of the fragments have been burned and the edges appear broken: one fragment (from N95/W133) is 21.0 mm in length, 7.85 mm in width, and 2.3 mm thick; the other (from S28/W192) is 14.15 mm in length, 5.4 mm in width, and 1.85 mm thick. The unburned abalone fragment (from S28/W194) has been cut along three edges (the fourth appears to have been broken) and is 19.5 mm in length, 20.15 mm in width, and 3.5 mm thick (Figure 9-1, b). Isolated Artifact 34, a triangular shaped shell pendant, was found near 24LN660. The pendant is made from an exotic (i.e., marine) shell that remains to be identified. All edges have been cut and are polished smooth. The pendant (Figure 9-1, a) is 47 mm in length, 22 mm in width at the base, and 8.1 mm in width at the top of the eye. It tapers in thickness from 2.75 mm at the eye to 0.55 mm at the base. The eye, located at the top of the triangle, is 4.35 mm in length and 2.95 mm in width.

The twelve bird remains were recovered from eight sites. None of the bird remains have been identified beyond class due to lack of a comparative collection. Three long bone shaft fragments have been burned and are temporally associated with the other archeological remains at 24LN447 (2) and 24LN677 (1). The remaining bird remains are all of recent deposition (i.e., intrusive).

The 86 fish remains recovered from 11 sites are part intrusive, for the most part. Only five have been identified to the family level: the Catostomidae from 24LN429 appears to have been buried (i.e., discolored), then exhumed, but is probably not associated temporally and the four Salmonidae are small vertebrae (probably trout). The Salmonidae from 24LN394 appears to be intrusive. However three salmonidae vertebrae from Feature 5 at 24LN427 have been burned and are considered to be "cultural" and associated temporally with archaeological deposits, as is the one unidentified fish bone. The remaining fish bones are undetermined taxonomically, although three have been identified tentatively as either minnow or sucker. Two of these from a test pit at 24LN366 appear to have been buried for a long time but probably are not temporally associated. Additionally, the unidentified fish bone from Feature 3 at 24LN427 has been burned and is considered to be archaeological. The remaining 77 fish bones are intrusive; most (64) are from 24LN691 and represent a single individual.

The vast majority (96.2%) of the faunal remains are mammal. Even the unidentified portion of the remains is considered to be mammal but bones are fragmented to such a degree that identification of general size class and/or skeletal element is not feasible at this time. A substantial portion of the recovered faunal remains is unidentified, 1,186 (27.3%). The only faunal remains recovered from 24LN1064 were three unidentified bone fragments. The majority of these remains have been burned and are less than 1 cm in size. The entire unidentified sample is considered to be archaeological.

Table 9-1. Summary of the Nonmammalian Faunal Remains Recovered from the Project Area.

Taxon	Number
Gastropoda (land snails)	51
River mussel	6
Abalone (marine)	3
Undetermined marine shell	1
Undetermined shell	6
Arthropoda (beetle)	1
Catostomidae	1
Salmonidae	4
Undetermined Fish	81
Bird	12
Turtle	1
TOTAL	167

carnivores. Rodents, herbivores, and humans also chew on bone; although human gnawing rarely modifies bone, with the possible exception of ribs. Rodent gnawing is demonstrated by short, parallel, incisor-caused, furrows in the bone, usually along the edges. The modification of bone caused by human agents is the result of skinning, dismemberment, filleting, marrow or bone grease extraction, and tool manufacture and use. Each of these activities usually requires the use of a tool of some sort. However, an animal can be skinned and butchered completely, without leaving a single mark on any bone (Guilday and Tanner 1962).

To summarize briefly, all the bone material from the project area was identified by monitoring eight variables. Once this was accomplished, the faunal remains were examined to determine temporal association. However, none of the criteria applied proved adequate to solve the problem of temporal association, and all determinations are tentative. Once temporal association is established, determinations are made as to whether human behavior or other activities resulted in the deposition of the remains. This step in the analysis also is tenuous, but by systematically applying a number of criteria (e.g., depositional context, nature of burning, types of fracture, and nature of surface modification) it is possible to determine, with reasonable accuracy, whether specific faunal remains are "natural" or "cultural."

Results

A total of 4,360 faunal remains (bone and shell) were recovered from 75 sites and 3 isolated locations (IA-12, 34, and across the river from 24LN392, see Appendices C and E). These remains include several bone tools and shell artifacts. Site by site descriptions of the recovered faunal remains are provided in Appendix E (Tables 1 and 2, site summaries of taxa by number and weight). Only 11 (14.7% of the 75 sites with faunal remains) yielded samples of greater than 100 specimens, whereas, 41 (54.8%) sites had sample sizes of less than 10 specimens. The faunal remains recovered from 15 sites discussed in Chapter 11 are described briefly and those from the project area as a whole are summarized as four samples: the nonmammalian remains (167 or 3.8% of the 4,360 items), the unidentified (probably mammalian) remains (1,186 or 27.2%), the identified (to family level) mammalian remains (239 or 5.5%), and the mammalian remains identified to generalized size class (2,768 or 63.5%).

The nonmammalian remains are summarized in Table 9-1. Most of the nonmammalian remains are not associated temporally with the archaeological remains. The exoskeleton of a beetle from 24LN1097, part of the plastron (belly plate) of a turtle (species has not been identified) from 24LN675, the unidentified shell remains (either river mussel or land snail) from five sites, and the 51 land snail shells or shell fragments from 10 sites are all intrusive. Several species of environmentally sensitive land snails were collected from the project area, mostly from subsurface deposits. These remain to be analyzed. Intrusive (i.e., "natural") shell material was the only fauna collected from two sites, 24LN704 and 24LN706. The six river mussel shell

only agents creating unusual skeletal element frequencies. Carnivores also dismember carcasses and selectively transport and/or destroy certain skeletal elements (Hill 1979; Binford 1981). Collections of selected skeletal elements could be the result of carnivore lair or den accumulations (Brain 1981; Binford 1981).

Not all burned bone can be assumed to be cultural. Burned bones could also be the result of forest and grass fires. However, the exposure to fire should be less intensive in natural situations. For this reason, the color of the burned bone (white, gray, black) and whether the bone was partially or completely burned is recorded as part of this analysis. When bone material is exposed to intense "natural" or "cultural" heat for a long period of time the organic portion is destroyed and the bone turns white in color, becoming calcined. Clearly all burned bone cannot be equated with human behavior. Conversely, unburned bone could result from human behavior, even food preparation. Along these lines, it should be noted that calcined, charred, and unburned bones were recovered from fire-cracked rock features readily assignable to past human behavorial practices. The point here is to emphasize that the context in which faunal remains are recovered is a critical factor in determining whether the remains are "natural" or "cultural."

Spiral fractured bones are not always the result of human behavior. Carnivores, expecially canids, also break bones into spiral fractures. Experiments have demonstrated that spiral fractures are a phenomenon associated with green bone rather than deliberate human action (Bonnichsen 1979). Old and weathered bone tends to fracture parallel to the bone structure (Tappen and Peske 1970; Behrensmeyer 1978). This [illegible] it possible to distinguish patterns of breakage due to weathering (old bone) from those associated with humans and dogs (fresh bones). It also is possible to distinguish between breakage by humans and that by carnivores (e.g., dogs). The edges of breaks caused by dogs are usually "chipped back, the microdenticulated effect" (Binford 1981:51). The edges also show some rounding and a degree of polishing. Bones broken by dog gnawing also should show other tooth marks such as punctures, pitting, scoring, and furrowing (Binford 1981). All these modifications would be absent on bones broken by humans, assuming the remains were not subsequently gnawed by dogs.

Bones exhibit marks caused by skinning, butching, and tool manufacture. In the past, marks on bone made by nonhuman agents have frequently been confused with marks made by humans. The acid content of tiny rootlets can etch bone where it is in contact with roots, usually forming random patterns. Under natural conditions bone becomes highly polished but this kind of polish can be distinguished from polish caused by human agents through use. Natural polish is general in character, that is, it covers all surfaces of the bone. On the other hand, cultural polish is localized, often being restricted to one or two surfaces. Geologic processes that transport bone can cause striations (usually random) and rounding of edges (Behrensmeyer 1975). The natural agent most often confused with human modification is chewing or gnawing on bone which is a widespread phenomenon and by no means restricted to

"cultural" or "natural" bones. "Cultural" bone is that portion of the faunal remains attributable to human behavior. This could include bone deposited as a result of recent hunting or ranching activities, but that is not associated temporally with the archaeological remains. "Natural" bone is that portion of the faunal remains which has been deposited by nonhuman means (e.g., death and in situ deposition, transport by geologic and fluvial processes, and transport by nonhuman predators and scavengers). This could include bone that is temporally associated with archaeological remains.

In order to determine whether a bone is temporally associated with the archaeological remains it is necessary to establish whether the bone is intrusive (of recent introduction to the archaeological context). Several criteria have been advanced to assist in this determination (Gustafson 1971; Ziegler 1973; Lyman 1976; Binford 1981). These include: (1) the index of skeletal completeness or "CSI" (Thomas 1971)--the more complete the skeleton the more suspect; (2) site location--bone in caves and rockshelters is suspect because of the behavior of predators and raptorial birds; (3) the degree of weathering and mineralization--intrusive bone should not be weathered to the same degree or have undergone the same chemical changes as archaeological bone; and (4) discovery context--whether the remains are recovered from the surface, in disturbed sediments, or in a discrete, well-defined feature. The problem of determining whether bone is intrusive is of particular importance to the project area and is made even more difficult to resolve when fluvial transport of bone ("float bone") is recognized as an ongoing mechanism of deposition and distribution of faunal materials. Experiments with fluvial transport of bone material have been conducted by Voorhies (1969), Behrensmeyer (1975), and Hanson (1980), and may be useful in solving this problem. Unfortunately, none of the criteria discussed here adequately resolve the problem of establishing temporal association, therefore all assessments concerning the faunal remains from the project area must be considered tentative. The CSI index is not useful in the project area, because due to slow rate of deposition carcasses are usually left exposed to the natural dispersal agents of scavengers. Likewise all bone, intrusive and archaeological, is exposed to the same natural processes of decay, mineralization, and weathering due to the slow rate of deposition.

Once a bone has been determined to be temporally associated, however tentatively, with the archaeological remains, the problem of determining whether its presence is due to human behavior and what type of behavior is even more difficult, and has not been resolved adequately. Several criteria have been used to suggest human behavior, but each criterion also can be linked to nonhuman agents. These criteria are: (1) unusual skeletal element frequencies, (2) burned bone, (3) broken bone (i.e., spiral fractures), and (4) butchering marks. These merit further discussion.

Unusual skeletal element frequencies are often a result of human selection, usually for bones to be used as tools and/or marrow extraction. Selected bones are transported from kill sites to residential camps as part of meat packets. However, humans are not the

Size of Fragment

This variable records the size (maximum dimension) of fragments in centimeters (i.e., <1, <2, <3, <5, <10, <15, >15). It is of use in inferring cultural activities or whether a bone has been culturally modified. This variable also includes information on whether a bone is complete.

Modifications

This variable includes any alterations (other than breakage) to the original bone, both natural and cultural. Cultural modifications are those made by human agents, including saw marks (a historic modification), cut marks, polishing (restricted), drilling, etc. Natural modifications are those made by nonhuman agents. These include gnawing by carnivores and rodents, weathering, polishing (general), root etching, etc. Burning is an exception, in that it could be either cultural or natural. The modification variable contains information useful in determining whether the bone is "cultural" or "natural" in origin and modification. This determination is essential to interpret the faunal remains, but in itself is not enough. This problem and possible solutions are discussed at length in the following section.

Number

This variable is the actual number of fragments and/or bones identified as belonging to an individual taxon, skeletal element, portion of skeletal element, side, size, and kind of modification present. New breaks are not counted separately but every effort is made to reconstruct the original bone/fragment. In cases where this is not possible, the newly broken bone fragments are counted as one. Due to small sample sizes, the actual number of bones/fragments is used in discussions, rather than minimum number of individuals.

Weight

This variable is the weight in grams for each taxon, skeletal element, portion of skeletal element, side, size, and modification. Because weights of less than 0.1 g are not measurable with the instruments used here, they are indicated by <.1.

Discussion

Traditionally, determination of whether bone is "cultural" or "natural" has been essential to the interpretation of archaeological faunal remains. But for the interpretation of the faunal remains recovered from the project area, a more critical assessment is whether the remains are associated temporally with other archaeological remains. This assessment does not necessarily equal the determination of

Table 9-4. Summary of Size Class Information from the Project Area.

Size Class	Number Size Class Only	Percent Size Class Only	Total Number	Total Percent*
Very Small	33	1.2	52	1.7
Small	210	7.6	287	9.5
Medium	1,432	51.7	1,495	49.8
Large	344	12.4	414	13.8
Medium/Large	749	27.1	759	25.2
TOTAL	2,768	100.0	3,007	100.0

*These numbers and percents represent the total number of specimens identified to generalized size; this includes those identified only to size and those identified to family, genus, or species.

Preservation of bone material in the project area is extremely poor and presents a problem for analysis of the faunal remains. Several factors contribute to this poor preservation, including slow deposition rate, acidity of the soil, and reservoir impoundment. The slow rate of sediment accumulation is perhaps the most important underlying factor controlling other destructive agents (i.e., carnivore/scavenger activities and weathering). Bone material in the project area remains exposed on the surface for long periods of time rather than being buried. The project area also has fairly acidic soil which is detrimental to bone preservation. Impoundment and operation of the reservoir accelerates bone destruction by varying the moisture content of the sediments. Also, innundation and subsequent drawdowns expose previously buried bone material, and may remove and/or deposit bone causing considerable mixing of the archaeological and intrusive bone.

Preservation conditions are also an indirect factor accounting for the highly fragmented nature of the faunal remains. Only 215 (4.9% of the entire sample) bones are complete but a large portion, 74.6 percent (3,254), of the remains are less than 2 cm in size. These bone fragments consist mostly of long bone shaft fragments and appear to be broken into pieces of shatter (fairly parallel sides or roughly rectangular blocky bone material) rather than green bone splinters associated with butchering or bone grease extractions. Natural factors of weathering and frost action cause bone to shatter. Cultural activities, such as using bone as fuel in fires or disposing of bone debris in fires, also cause bone to shatter, in addition to burning it.

The majority of the faunal remains (3,379 or 77.5 percent of the 4,360 faunal items) from the project area have been burned to some extent. This may be a factor of preservation (i.e., burned bone appears to be better preserved), judging from the fact that of the 1,908 bones recovered from subsurface deposits (i.e., buried bone sample) 79.6 percent (1,518) have been burned. The duration of exposure to and the intensity of heat are indicated by color of the burned bone (e.g., white bone is intensely burned, while black bone is only charred). Taking this into consideration, most of the burned bone material (2,382 or 70.5 percent of the 3,379 burned items) has been exposed to a fire of relatively intense heat for a period of time. This portion of the burned bone also accounts for a large portion of the small (less than 2 cm) bone bits or shatter. The burning of bone as fuel may be supported by the bone and fire-cracked rock features at five sites, 24LN388, 24LN427, 24LN666,24LN677, and 24LN708 containing large amounts of intensely burned bone. The distinction between deliberate use of bone as fuel and disposal of bone debris by burning is important, for it affects interpretation of past subsistence behavior. If bone was deliberately used as fuel, people probably would have collected additional bone from natural sources, such as winter-killed deer carcasses or other natural deaths, to supplement that derived from carcasses brought to sites for consumption. Such factors would upwardly skew the amount of bone material and bias subsistence interpretations.

Inferences about subsistence behavior based on the recovered faunal remains are limited for several reasons, the most important being the

low percentage of identifiable archaeological remains. Lithic analysis indicates that hunting and processing of ungulate resources are the main subsistence activity in the project area. This is supported by the faunal remains. Most of the identified archaeological fauna are ungulates; in order of abundance these are deer, elk, sheep, bison, and caribou. These 55 specimens came from 25 sites. The archaeological fauna also give some indication that smaller game animals such as rabbits were important, but the abundance of rabbit (Leporidae) is misleading as 41 of the 49 remains came from one site (24LN1054) and may represent only one or two individuals. The remaining eight specimens came from four other sites. Birds and fish are also of some minor value. Due to the extremely small sample size any calculation of dietary importance is impossible. The extremely fragmentary nature of the remains also makes determination of butchering practices impossible. Detailed descriptions of cut marks and other deliberate human modifications other than burning, breakage, and tools are provided in Appendix E, Table 3.

The anticipated use of faunal remains to substantiate the research question of subsistence intensification through time has not been realized for reasons discussed previously. Furthermore, most of the sites are multicomponent (i.e., used during more than one time period), or of unknown age. Only twelve sites with archaeological fauna can be distinguished using chronologically diagnostic period markers. This method assumes that all the archaeological material at the site belongs to the same occupation/time period as the diagnostic period marker. In order to test subsistence intensification through time these twelve sites have been divided into an Early/early Middle Prehistoric Period data set and a late Middle/Late Prehistoric Period data set. Table 9-5 lists the archaeological fauna for each period. The small sample size for the early period will influence any interpretation of changes in subsistence and may be an effect of the age of the sites (i.e., the older the site the less bone preserved). The large amount of unidentified remains (43.0%) also may be a function of the age of the sites and preservation. The Early/early Middle Prehistoric faunal remains are characterized by a dominance of medium size mammals (probably deer), when the unidentified and undetermined medium/large size mammals are excluded. Also small size mammals (e.g., rabbits) are more abundant than large mammals. The late Middle/Late Prehistoric faunal remains are characterized by a greater variety of taxa including exotic shell, bird, deer, elk, and probably bear. The medium size mammals (most are considered to be deer) are the largest portion of the remains (43.5%). The unidentified remains represent a sustantially smaller portion of the remains (24.8%) than the early sample. The large size mammals (probably elk) are more abundant than small mammals. To a certain extent this is indicative of subsistence intensification through time with an increased reliance on medium size mammals (deer), an increased use of large size mammals (elk), and a greater diversity of taxa represented in the late Middle/Late Prehistoric Period.

Perhaps a more meaningful test of subsistence intensification through time is to compare the entire Washington State University sample (N=124) of identified faunal remains, from an archaeological context to

Table 9-5. Archaeological Fauna from Sites with Single Component Chronologically Diagnostic Period Markers.

Time Period	Site Represented (Number of Items per Site)	Taxa	N (per taxa)	%
Early/Early Middle Prehistoric Period	394 (2)	Leporidae	2	1.6
	429 (121)	*Odocoileus* sp.	1	0.8
	1035 (2)	Small	10	7.8
	1064 (3)	Medium	35	27.3
		Large	4	3.1
		Medium/Large	21	16.4
		Unidentifiable	55	43.0
TOTAL			128	100.0
Late Middle/Late Prehistoric Period	366 (136)	Abalone	3	0.2
	389 (1)	Bird	1	0.1
	399 (5)	*Odocoileus* sp.	8	0.5
	417 (67)	*Cervus canadensis*	1	0.1
	423 (30)	Large carnivore (i.e., bear)	1	0.1
	443 (105)	Small	37	2.6
	677 (1,096)	Medium	628	43.5
	711 (5)	Large	96	6.6
		Medium/Large	311	21.5
		Unidentifiable	359	24.8
TOTAL			1,445	100.0

the LAURD sample of identified archaeological faunal remains (N=1,470) (Figure 9-2). Information on the number of items identifiable only to size class was not developed as part of the LAURD faunal analysis. All data used for this discussion are from Table II.1 in Appendix II of the LAURD report (Henry 1982). The most obvious and major difference between the LAURD data and those generated for this project is that the former sample comes from only six sites whereas the Washington State University (WSU) sample is from 37 sites. The WSU faunal sample is biased towards later sites or later components because of preservation conditions. Earlier sites simply lack identifiable bone and in some cases any bone material at all. The LAURD sample came from comparatively younger sites located on lower terraces while the WSU sample came from potentially older sites located on higher terraces, but due to preservation the more recent faunal remains might be represented better than the older remains. Given these considerations and for purposes of hypothesis testing later, it is reasonable to characterize the WSU sample as one of early faunal remains and the LAURD sample as one of late faunal remains.

Assuming that the presence of archaeological faunal remains equates with aboriginal utilization, the WSU or early faunal remains are characterized by a more even use of the resources base (Figure 9-2) when the rabbit remains are adjusted. This is done by considering the number of sites from which rabbit remains were recovered as opposed to counting the number of items. Overall, the WSU sample is dominated by ungulate resources, especially deer. Five taxa of ungulate resources were utilized, including two that do not appear in the LAURD sample, caribou and possibly bison. A more limited number of small animals were used (only four taxa: fish, bird, rabbit, and dog) from a potentially large resource base. The LAURD or late faunal remains are overwhelmingly dominated by deer, all other animal resources appear to be of minimal importance. Even though deer dominate the sample, the ungulate resource base is more restricted than the earlier sample in that only sheep and elk were utilized. On the other hand, the other animal resources in the LAURD collection exhibit a much wider range including four taxa not in the WSU sample: beaver, lynx, fox, and bear. In addition to this, the bear remains appear to be almost as important as elk.

This comparison of the WSU/early faunal sample with the LAURD/late faunal sample also suggests subsistence intensification through time. The early remains demonstrate a dependence on ungulates that is wide ranging (i.e., use all available ungulate resources). Other animal resources are also important but restricted in variety. The later remains show an overwhelming dependence on a single resource, deer, with additional animal protein provided by a more diverse animal base, including more small mammals, bear, sheep, and elk.

Although the sample of archaeological faunal remains from the project area is small, the following conclusions are in order: (1) preservation conditions are responsible for the small sample size and bias the collection toward later period sites; preservation also is responsible for the large portion of unidentified remains; (2) burning helps to preserve bone in the project area; burned bone may be the

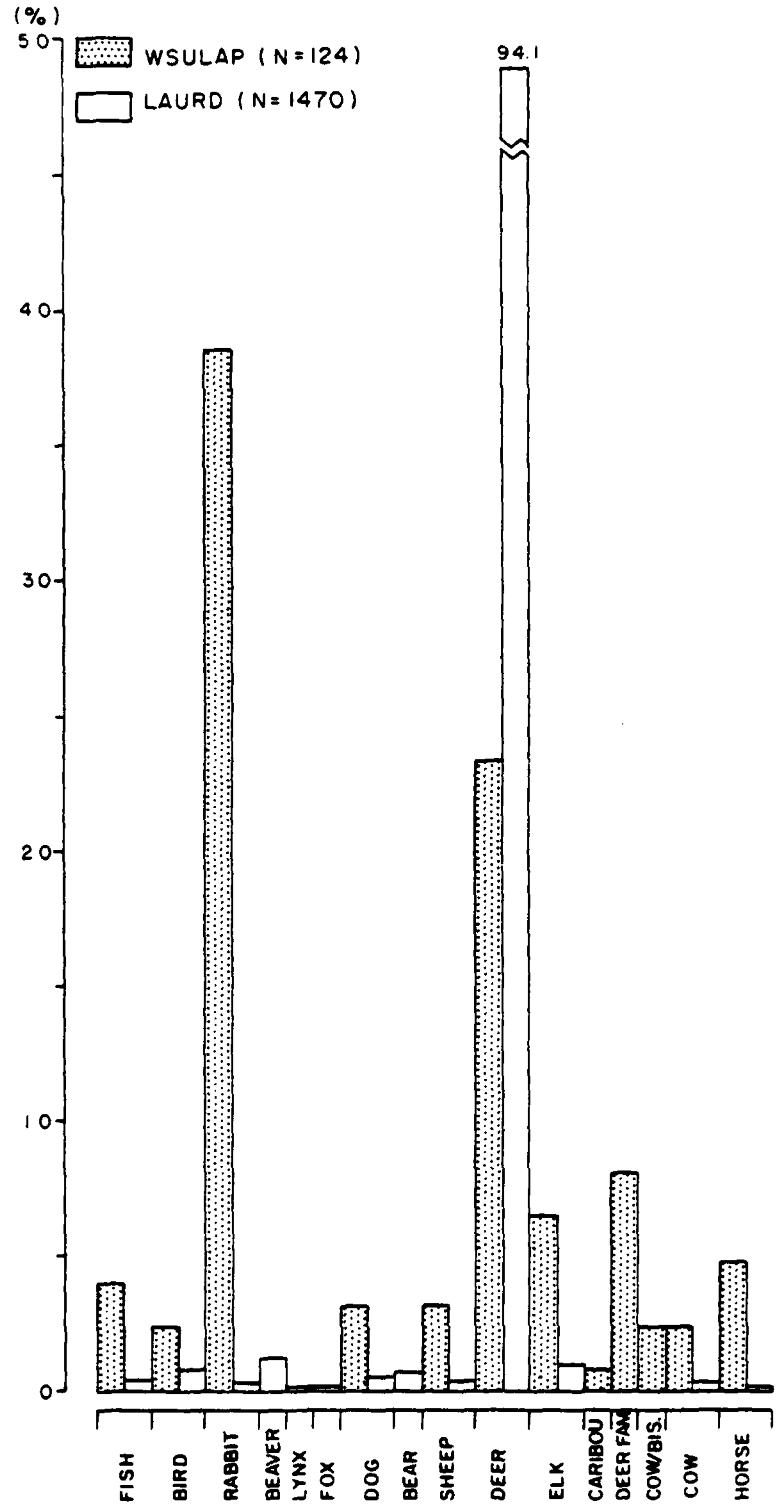


Figure 9-2. Comparison of the identified archaeological faunal remains (including historic species) between WSU and LAURD projects.

result of two cultural activities, disposal of debris by burning and use of bone as fuel; (3) reliable inferences about subsistence are limited, but hunting of ungulates appears to have been a major, if not the most important activity; and (4) the faunal remains offer limited support to the hypothesized pattern of subsistence intensification through time.

CHAPTER 10

HISTORIC SITES AND ARTIFACTS

by
Alston V. Thoms

Historic sites and artifacts discussed here are those considered to have been deposited on the landscape mainly by nonaboriginal populations, particularly those of European ethnic affiliations and/or by individuals or groups so involved in the Western socioeconomic system that their cultural remains are identical, for all practical purposes, to those of Europeans and their decendants. Such a broad definition is necessary because Kutenai and other Indian peoples lived in the area until slightly less than 100 years ago. During the latter part of their tenure, they participated in the Western socioeconomic system to a large extent (Chance 1978). Thus, some of the later nineteenth century historic materials (e.g., tin cans, ammunition, and kitchen utensils) could have been deposited by the Kutenai or other Native American peoples. Furthermore, individuals of Africian, Asian, Latin American, and South Pacific ethnic affiliations used the area and probably deposited European artifacts. The kinds of artifacts that are of probable European manufacture, but are indicative of Native American activities (e.g., glass beads and sheet copper ornaments) are termed historic aboriginal. The artifacts and sites indicative of Euroamerican (i.e., Western) activities are termed historic nonaboriginal in a technical sense, but unless otherwise noted, the term historic designates nonaboriginal cultural materials.

As measured by the presence of Europeans in the project area and vicinity, history has a time depth of almost 200 years. By 1795 European fur traders had contacted the Kutenai people and by the early 1800s trading posts were established within the project area (Chance 1981). Early historic era activities were confined largely to the valley bottom in proximity to the Kootenai River. Gold mining and initial Euroamerican settlements, as well as their transportation routes and towns were restricted largely to valley bottom locations. It was only late in the nineteenth century that Euroamericans began to occupy valley wall locations with enough intensity to leave an obvious record of artifacts (e.g., glass bottles and ammunition) and features (e.g., springboard notched tree stumps, houses, and trash dumps). Unfortunately, the valley bottom was not accessible during the course of the field investigations reported here. However, during the course of survey work in 1981 and 1982 numerous historic sites were documented at locations along the valley walls.

Most of the historic sites recorded during the survey, as well as the artifacts collected and/or observed are readily attributable to late nineteenth or twentieth century occupations. This observation is a significant one, albeit well known. It documents a temporal shift in

land use patterns, from an initial and rather restricted focus on the Kootenai River and valley bottom to one that also encompassed the higher terraces and valley walls. Interestingly, that tendency is opposite to the one noted for the aboriginal populations whose settlements appear to have been located initially on the valley walls and subsequently on the valley bottom.

Documentation of the surface of historic sites was essentially like that used for aboriginal sites. However, the recovery of historic artifacts was not one of the major objectives of the project. Analysis of historic artifacts was more limited than for aboriginal artifacts; it was confined primarily to classification and brief descriptions. From a contractual standpoint, the only obligation was to map three historic sites (US Government 1981a:11).

Historic sites data presented in the chapter (6) on the general nature of cultural resources are expanded upon here. The first subsection includes a brief discussion of the nature and distribution of historic artifacts recovered or observed during the course of survey work. Next the nature and distribution of historic sites in general are discussed and descriptions of three historic sites are presented.

Historic Artifacts

Historic artifacts are those items judged to derive from Euroamerican utilization and occupation of the region. Examples include, but are not limited to, metal, glass, and ceramic containers, machinery parts, and the remains of houses, cellars, and barns. These kinds of remains are recorded at 78 (31.3%) of the 249 sites encompassed by Lake Koocanusa and the immediate vicinity. By convention, sites with aboriginal and nonaboriginal cultural materials are not classified as historic. Thus, while historic materials are documented at 78 sites, only 27 of the sites are classified as historic. In addition, two of the isolated artifact finds were historic artifacts; IA-3 is a glass bottle made for battery oil and IA-9 is a rim fragment of a glass bottle (see List of Isolated Artifact Finds in Appendix C). With the exception of the sites with historic structures, most of the historic artifacts recorded in the project area probably are indicative of comparatively recent trash dumping activities and the haphazard discarding of unwanted or used items.

The artifact collection includes historic materials from 31 sites in addition to the two isolated finds. For descriptive purposes the historic artifacts are placed into one of four categories--metal, ceramic, glass, and other--depending upon the kind of material from which they were made. These basic categories of artifacts were then subdivided into groups on the basis of function or more precise material type criteria. The kinds of historic artifacts recovered are summarized in Table 10-1. Brief descriptions and a site by site tabulation of recovered historic artifacts are presented in Appendix F.

Table 10-1. Summary of Historic Artifacts Recovered from 31 Sites in the Project Area.

Artifact Category	Artifact Group	Number of Specimens	No. of Sites Represented
Metal	Common Household Items	15	5
	Can and Can Fragments	20	6
	Fencing Material	5	3
	Farm/Ranch Equipment	15	2
	Square Nails	9	3
	Round Nails	157	6
	Miscellaneous Construction Items	25	4
	Cartridges	14	8
	Bullets	12	7
	Coins	2	2
	Rivets and Rivet Buttons	7	3
	Miscellaneous Personal Items	5	3
	Unknown Items and Unidentified Metal Fragments	7	4
	Subtotal	293	21
Ceramics	Stoneware	5	2
	Earthenware	27	8
	Porcelain	11	6
	Subtotal	43	10
Glass	Windowpane-Clear	154	3
	Container-Clear	15	6
	Container-Aquamarine	39	9
	Container-Green	8	4
	Container-Purple	24	8
	Container-Amber	16	4
	Other Items	16	7
	Subtotal	272	17
Other	Buttons: Shell, Plastic, Other	7	4
	Trade Items: Beads, Copper	6	3
	Miscellaneous	3	3
	Subtotal	16	10
	TOTALS	624	31

Historic Sites

The focus here is on the 27 sites classified as historic. As noted, an additional 51 sites have a historic nonaboriginal component, but they are considered to be aboriginal sites for analytical purposes. Two kinds of historic sites are recognized. The 20 sites with structural remains are termed historic structure sites and the seven sites represented only by scattered items are termed historic debris sites. The identified historic structure sites are either farm/-ranchsteads or the remains of logging camps or log flumes such as the one near the mouth of Bristow Creek (site 24LN409). None of these sites appears to be older than 100 years. As noted elsewhere, all of the structure sites within the confines of Lake Koocanusa were razed prior to impoundment.

Most of the historic sites are located in the Tobacco Plains zone, including six of the seven debris sites and 12 of the 20 structure sites. One debris site and two structure sites are found in the Upper Canyon zone. The Lower Canyon zone has six structure sites and to that must be added 24LN1070 an aboriginal site, with several standing historic structures, located above the reservoir high water level and near the mouth of Canyon Creek. Historic structure sites are found at various distances from permanent water sources. Almost half (9) of them are far (i.e., more than 300 m) from permanent water, seven are within moderate distances (i.e., 100-299 m) of permanent water and only four of the historic sturcture sites are within 100 m of a permanent water source. Historic debris sites are also found at various distances from permanent water sources, but the more informative aspect of their location is that they tend to be in immediate proximity to roads. This would be the expected location of sporadic trash dumping activities.

Structure sites are most common in the Tobacco Plains zone, probably because that is the area with the largest expanse of agricultural lands. Historic structure sites in the canyon zones tend to be situated on the larger and flatter landforms, but not necessarily in immediate proximity to large expanses of agricultural lands. However, there are generally a few nearby acres of potential agricultural lands. These small acreages would have been adequate for a garden and small field of sufficient size to produce food for a family and livestock. As noted, structure sites related to logging activities also are found in the area.

The sites described in the following paragraphs are selected because they illustrate the range of structure sites with regard to age, location within the project area, and presumed function. Site 24LN370 is an extensive logging camp in the Lower Canyon zone; it probably was used most during the first half of the twentieth century. The farm/ranchstead (24LN687) that is part of the south Ten Mile Creek Site Complex in the Upper Canyon zone was probably occupied some time well after the turn of the century. Site 24LN701, a Kootenai Flats (Tobacco Plains zone) farm/ranchstead, was occupied during the early 1900s and possibly earlier.

Draft site descriptions were written by Lynne MacDonald (the project's historical archaeologist) and this is noted parenthetically in each case. Subsequently, site descriptions were reformated and rewritten based on newly available information. MacDonald also carried out deed searches in the Lincoln County archives in an effort to determine property ownership, site function, and time of occupation. Unfortunately, neither time nor funding was available to conduct oral history interviews and use the resulting data in the assessment and interpretation of the historic cultural resources.

24LN370 (Lynne MacDonald)

Sites 24LN370 and 24LN379 were recorded in 1981 as two distinct historic sites. Further examination demonstrated each to be an element of a single camp. For this reason, the designation 24LN370 is used for the entire site. Site 24LN370 is located 450 m south of Cripple Horse Creek in the Lower Canyon zone. It is one of ten sites in the Stuck Truck Site Cluster (Figure 10-1). In addition to aboriginal materials, four of the sites--24LN368, 24LN369, 24LN697, and 24LN703--have considerable amounts of scattered historic artifacts that probably are related temporally to 24LN370. Of the ten sites in the complex, only 24LN370 is classified as historic. Two--24LN307 and 24LN368--are classified as fire-cracked rock and bone sites; the others are all low diversity sites. Site 24LN370 is situated at 2,490-2,450 feet (ca. 754 m) amsl on T8. It is largely above the high water level of Lake Koocanusa. The site has a western solar exposure.

Several intermittent streams flow through the site (Figure 10-2), but the nearest permanent water source is the Kootenai River, approximately 1 km west. Existing vegetation consists of mixed conifers, underbrush, and native grasses.

The site is in fairly good condition. Reservoir wave action is cutting away the terrace banks, however, and poses an immediate threat to one feature (F-16). With the exception of Feature 16, the structures have collapsed and several appear to have been disturbed since their collapse, probably by people salvaging lumber. Most features are made of boards or logs that are now well weathered and soft. Rusted and fragile tin cans are the most common non-structural debris found at the site.

General Nature of Cultural Materials

Site 24LN370 consists of 25 historic features scattered over an area approximately 360 x 120 m (Figure 10-2). Features located include collapsed board structures, privy pits, dumps, log trestle bridges, and cut and banked corduroy roads, as well as a number of unidentified structures. All structures are of milled dimensional lumber with wire drawn nails. The site is located on Lot 5, Section 10, T31N, 1229W, which was filed on in 1909 and patented in 1959.

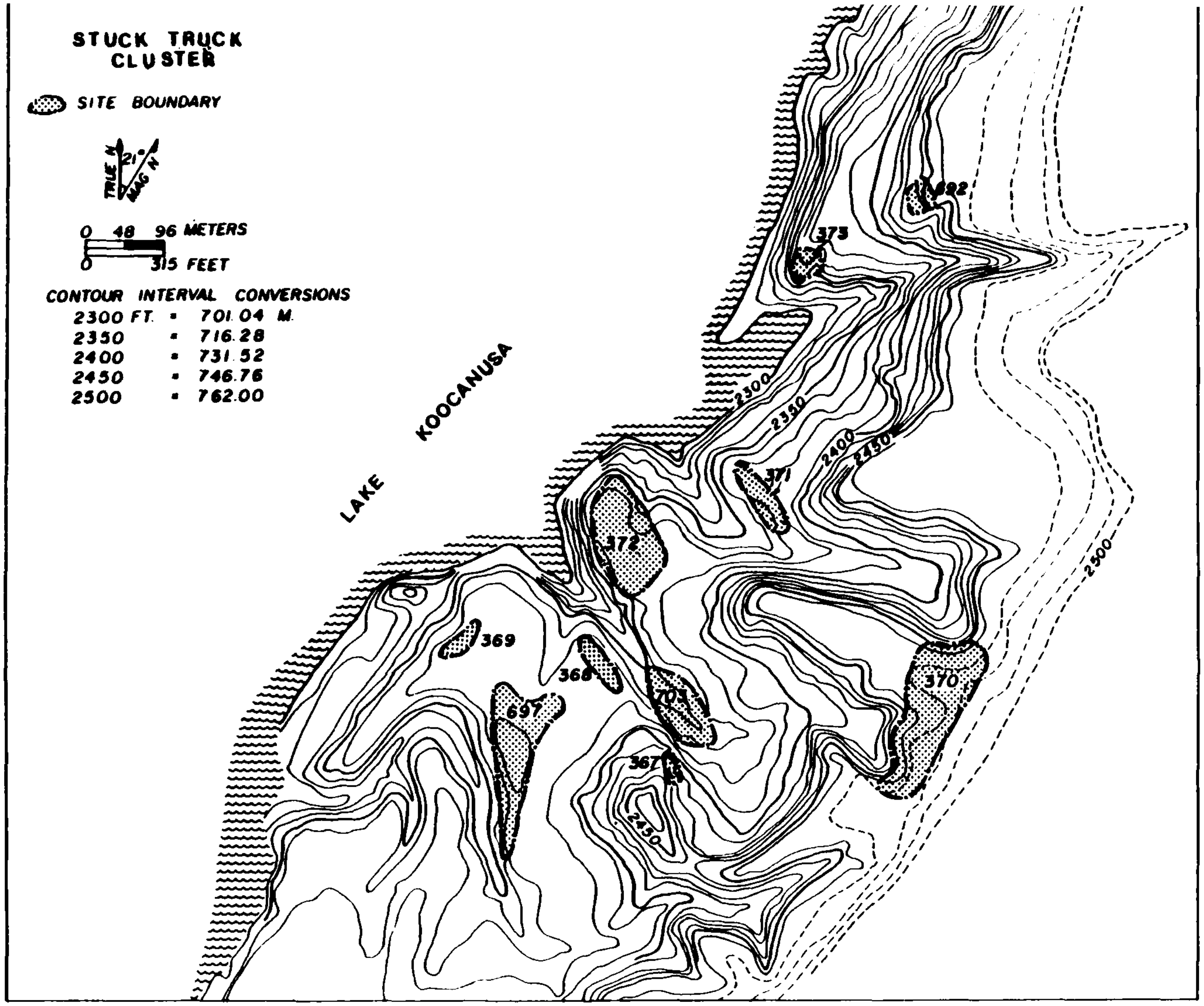


Figure 10-1. Map of Stuck Truck Cluster showing location of 24LN370.

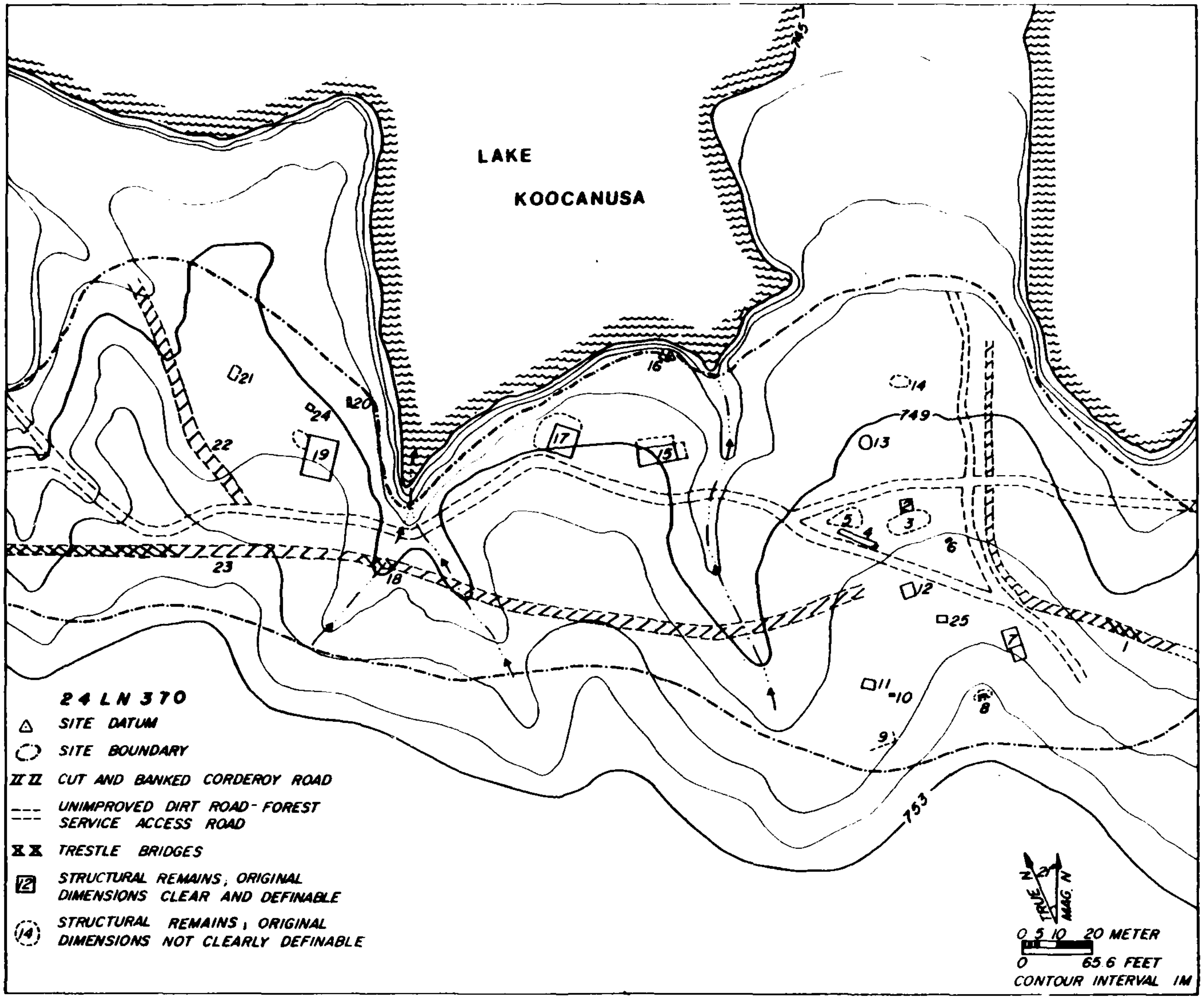


Figure 10-2. Map of 24LN370 showing location of 25 features.

into the slope and may be a root cellar. Relic collectors have excavated a pit just inside the structure's south wall and trenched along the inside of the wall to the east and west. A second relic collector's trench extended northward through the fill. This disturbance revealed an undressed log wall extending at least 4 m east/west on a line 80 degrees east of north. It appears that the collectors trenched until they encountered the structure's east wall, consisting of two stacked, horizontally laid logs. To the west the trench exposed a wall four logs high. The fill contains milled boards that may represent a collapsing roof. The relic collectors' backdirt piles contained chunks of decayed logs, milled board fragments, wire drawn nails, small chunks of concrete mortar or chinking, small fragments of window screen and one saw-cut long bone. Neither glass nor ceramic artifacts were observed there.

Feature 3, located west of Feature 2 and near the base of the slope, consists of a mass of barbed wire and several burned fence posts. Unique to the feature area is a localized scatter of small rounded pebbles (about 5 cm in diameter). The feature may be the remnants of a small corral or animal pen, and the pebbles may have been exposed when the posts were pulled from the ground in the process of dismantling the pens.

Interpretation

Site 24LN701 probably was occupied in the early to mid-twentieth century. It may be the William Swanson homestead; Swanson filed on the land in 1929.

Distribution of cultural material indicates that the main site area was located on top of the slope, and that Feature 2, below the slope was probably a root cellar. The scatter of unmodified cobbles may be remnants of a foundation or chimney.

Most cultural materials were manufactured about 1920 or later. Several applied style, medicine bottle tops (manufactured between 1881 and 1920) were found, but all beverage bottle fragments were the type manufactured on an automatic machine. All beverage bottles had crown caps, in general use after 1907. A number of fragments of manganese content glass (discontinued in 1915) were observed, as were a few fragments of clear glass (manufactured after 1930).

Tin cans were generally the open-top variety available after 1900. Square nails were not observed, but quantities of wire drawn nails were found in association with Feature 1. Wire drawn nails were in general use after 1895.

The chain of ownership indicates that Swanson filed on the land in 1929, and then sold to Peter Borup in 1935. An examination of tract records for other Kootenai Flats sites reveals numerous occurrences of Borup's name. Apparently he was purchasing a sizable tract of land. It is quite likely, then, that any structures Swanson built on his claim were abandoned under Borup.

Lincoln County Courthouse, Libby, Montana, indicated that the quarter-quarter was Lot 4B, originally part of Lots 1 and 2, encompassing the E 1/2, NW 1/4 of Section 18. The Claim of Ownership for Lot 4B began in 1929 with William Swanson and ends in 1969 with the US Government.

A plot map in an undated tract book, compiled some time after 1955, listed H. D. Smiley as the landowner. However, no structures were illustrated in the site vicinity.

Site Documentation Methods

Site investigations entailed surface survey, mapping feature and artifact distributions, collecting potentially diagnostic artifacts, and excavating two 1 x .5 m shovel skim on top of the low dune. The purpose of these activities was to collect material useful in dating the site, identifying its function, and determining the depth of the cultural deposits. Some of the pot hunter's backdirt piles were screened in an effort to recover additional materials.

Descriptive Results

The site consists of a surface scatter of debris and the remains of three features. Surface debris includes bottle and window glass, stoneware bottle fragments, other ceramic fragments, wire drawn nails, tin can and container fragments, and miscellaneous hardware fragments. Most of the surface scatter is in an area, approximately 20 x 50 m in size, at the north end of the site and on top of the slope. Much of the visible material is associated with relic collectors' backdirt piles.

Several concentrations of unmodified cobbles are located within the dense artifact scatter area. Similar cobbles outcrop naturally in terrace banks approximately 75 m east of the site, but do not occur naturally on the site surface. No evidence of foundations or depressions is associated with the cobbles. Relic collectors' holes have disturbed the three concentrations in the dense scatter areas, but have yet to impact the small concentrations of artifacts in other areas of the site.

Feature 1, located within the dense scatter area, is a square depression 67 x 70 cm in size, with the walls faced by milled boards to approximately 17 cm below surface. This feature is damaged by relic collectors and most of the board facing has been stripped away. No superstructural features remain; sediments in the bottom of the depression appeared to be in situ sands rather than post-reservoir fill. The relic collectors' backdirt piles yielded hundreds of wire drawn nails.

Feature 2, also exposed as a result of relic collectors' activities, is the buried remnant of a log and board structure located on the site's south slope and covered by approximately 10 cm of sandy, pos-reservoir sediments. The structure appears to have been excavated

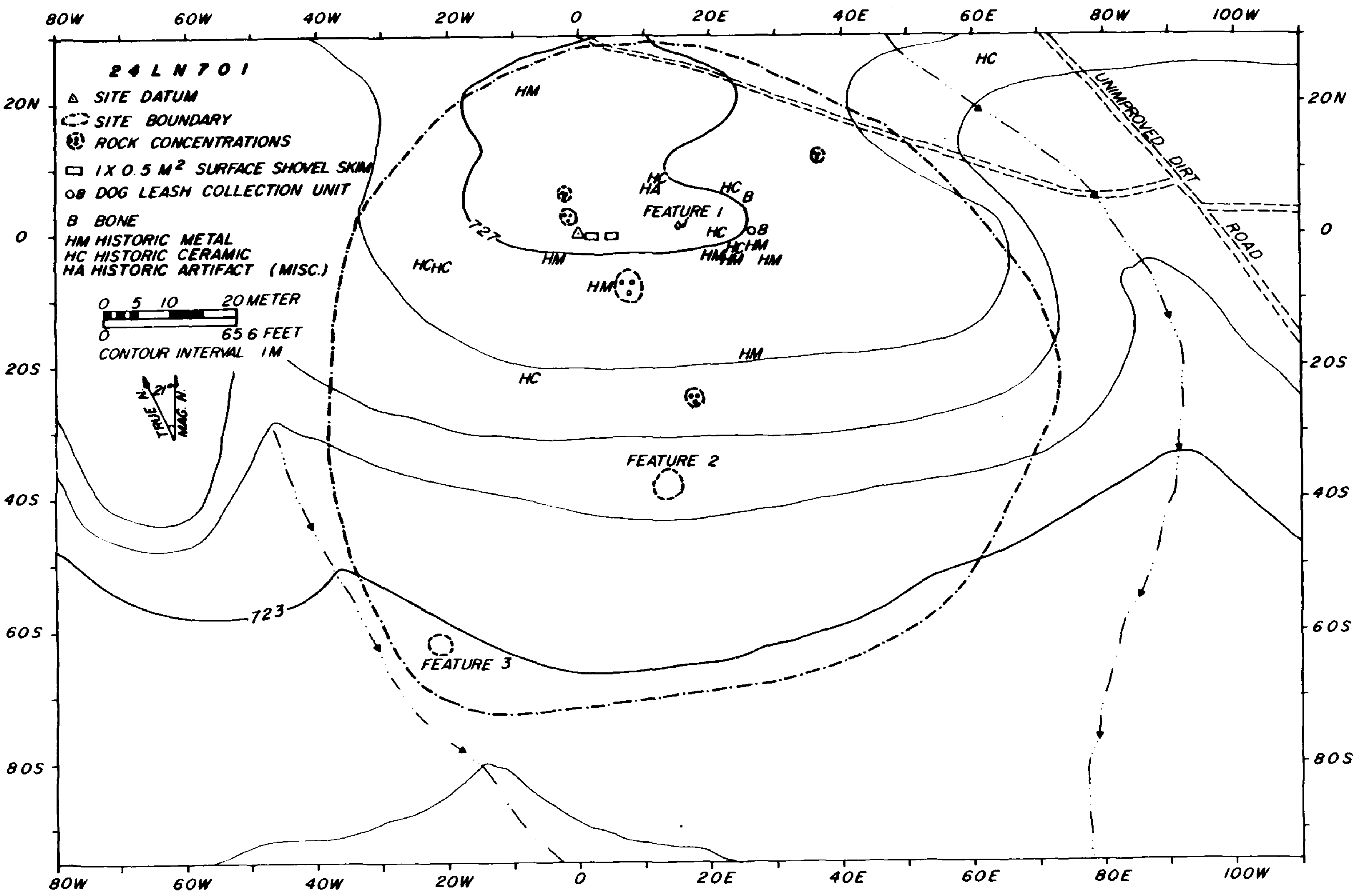


Figure 10-4. Map of 24LN701 showing the location of features and artifacts.

Feature 4 consists of surface concentrations of crushed brick in a 100 m^2 area. The crushed brick concentrations are approximately 5 cm deep and overlie an unmodified surface. One concentration is associated with a burned and truncated, in situ post. Debris associated with the feature includes quantities of wire drawn nails, ranging in size from finishing to bridge nails, a few burned, milled boards, bolts, a horseshoe, and window glass fragments. A 1902 liberty-head quarter also was found in the area.

Debris scattered generally over the site area include ceramic fragments with various design motifs, rifle shell casings, a small lead ball, kerosine lantern fixtures, animal bone, both cut and uncut, and bottle glass.

Interpretation

Tract book information indicates that a claim was not filed on the land upon which the site is situated until 1923. Cultural materials are consistent with an early-middle twentieth century occupation date. All bottle glass found was made by automatic machines in use after 1920. Several pieces of clear glass were found, and clear glass was not used widely until after 1930.

Material found indicates that 24LN687 was an occupation site, possibly Graham's homestead. Both domestic (ceramics, jelly glasses, canning jar fragments, buttons, food bone), and nondomestic (heavy bolts, cable, horseshoes) cultural materials are abundant. It is likely then, that the site consists of remnants of a homestead cabin (probably Feature 2) and some kind of outbuilding (Feature 3).

24LN701 (Lynne MacDonald)

Site 24LN701 is located on the west edge of Kootenai Flats in the Tobacco Plains zone. The site is situated at 2,380 feet (ca. 725 m) amsl on the south facing edge and slope of a low dune overlooking Sophie Creek and the flat extending to the south. Sophie Creek is 100 m south and 3.1 m below the site. Intermittent streams, dry in April, traverse the areas east and west of the site. The 1962 topographic map indicates that the site area was open at that time.

The site has been subjected to extensive relic collection activity including digging that has disturbed both surface deposits and subsurface features. The upper sediments on the landform have been eroded by reservoir waters; only 2-3 cm of culture bearing sediments remain on the tested portion of the dune.

Results of Records Research

Site 24LN701 is located in the NE 1/4, NW 1/4, Section 18, T37N, R27W. Examination of tract books at the Clerk and Recorder's Office,

The site area is disturbed extensively by reservoir related activity. Surface disturbance by heavy equipment, likely used in logging, is readily apparent. At some point in time, probably just prior to reservoir impoundment, the structures were burned and/or dismantled.

Results of Records Search

Site 24LN687 is located in the SW 1/4, SW 1/4, Sec 27, T33N, R28W. Examination of the Lincoln County Tract Books (housed in the Clerk and Recorder's Office, Lincoln County Courthouse, Libby, Montana) indicated that Benjamin H. Graham patented a claim to this and other acreage in Sections 27 and 28 on January 31, 1923 (patent no. 891579; Homestead Entry Serial no. 1056). The remaining portion of Section 27 has been in Forest Service ownership since 1909. On March 12, 1945 Graham sold his acreage to Claude C. Norris, who sold to the US Government on December 1, 1967. An undated tract map, probably compiled after 1950 based on landowners listed, illustrates a structure in the approximate location of Site 24LN687 (Clerk and Recorder's Office, Lincoln County Courthouse: untitled plat book).

Site Documentation Methods

Investigations were limited to the collection of potentially diagnostic artifacts and site mapping. All collected items were point provenienced. The site was mapped using a hand-held compass and tape. Several trowel probes were dug in and around in situ posts and crushed brick concentrations in an attempt to determine the nature and function of these features.

Descriptive Results

Four features and scattered debris are visible on the surface over a 4,275 m^2 site area (Figure 10-3). Feature 1 is a surface dump roughly 2 x 5 m in size, containing open-top tin cans, glass and earthenware fragments, and strap metal. Thinly scattered debris is visible over approximately a 100 m^2 area around Feature 1. Feature 2, located 25 m west of Feature 1, is a collapsed, burned, and apparently razed structure. All that remains is a pile of milled lumber with embedded wire drawn nails and three truncated, but in situ posts. No foundation or depression was visible. Cable, re-bar, a horseshoe, rifle shell casings, and large quantities of wire drawn nails are concentrated in the vicinity.

Feature 3 consists of in situ, truncated posts and a 2 m^2 concentration of unmodified rock that apparently delimits three corners of a structure approximately 10 x 7.5 m in size. No foundation is visible and no evidence of the superstructure remains. Cultural debris in the vicinity includes a condiment jar with a patent date of August 5, 1919, a rubberized boot, a horseshoe, wire, and window glass.

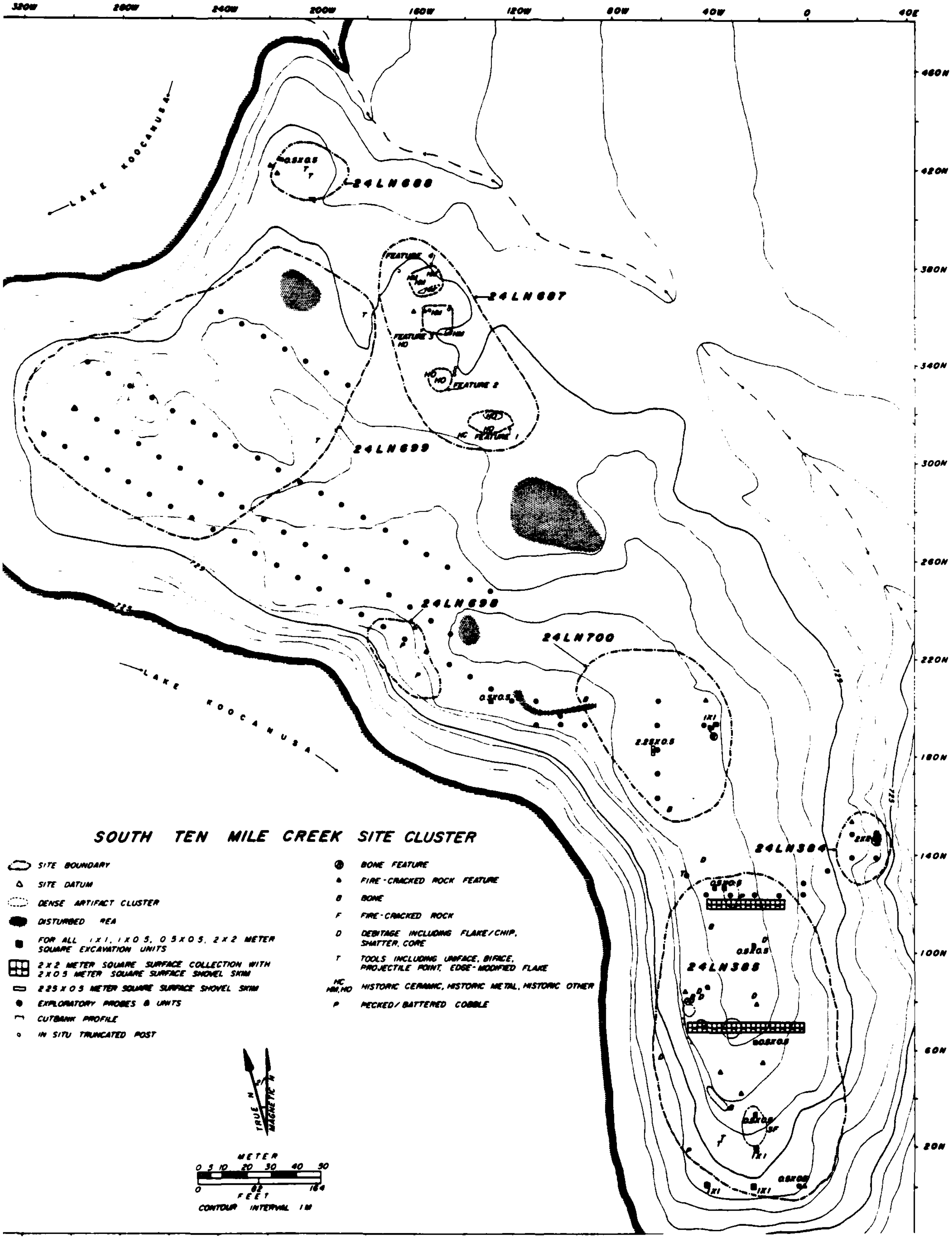


Figure 10-3. Map of the South Ten Mile Creek Site Cluster showing the location and contents of 24LN687.

structures have an associated privy. Features 7 and 9 also may be residences, as each has an associated privy, and the one nearest Feature 7 has a large number of food cans nearby.

Most of the remaining features are identified less easily. They are concentrated where two of the corduroy roads begin to converge. It may be that this was an area of work related structures or features. Features 3 and 5 may have been offices, Feature 4 was almost certainly a mounting for a piece of machinery, and Feature 12 also appears to have been a mounting or pad for some large or heavy object. Perhaps Feature 12 supported a water tank, as no permanent or sizeable natural source of water is available at this site.

The camp does not appear to have been constructed for use as a long-term work or occupation site. None of the structures were built on well formed foundations, and many appear to be crudely built from a miscellany of boards. Several of the possible residential structures appear to have been little more than roofed platforms. It is also notable that only one fragment of window glass, was found at the site, indicating that several of the structures may have been little more than roofed and floored frames from which tent walls were suspended.

Two, small tin can dumps contained most of the food remains observed. It is probable that the occupants lived there only for a short time, and transported most of their trash elsewhere, perhaps downslope where historic debris similar to that at 24LN370 is scattered widely.

All these factors indicate that the camp probably was built to be occupied for a single season's logging. It probably was designed to be at least semi-mobile, with portions of buildings and all equipment readily removable for relocation at the next camp.

24LN687 (Lynne MacDonald)

Site 24LN687 is located on the east side of the Kootenai River and south of Ten Mile Creek in the Upper Canyon zone. It is part of the south Ten Mile Creek Site Cluster (Figure 10-3). Of the seven sites in this cluster only 24LN687 is classified as historic. Three sites--24LN384, 24LN688, and 24LN699--are low diversity sites. The other two are classed as FCR only (24LN689) and FCR and bone (24LN700) sites. Site 24LN687 is situated on T5 at 2,390-2,380 feet (ca 727 m) amsl. The terrace slopes abruptly to the west and south and is cut on the east by an old river channel that is now the course for an intermittent stream. The site is located on the gentle north slope of the terrace and has a northeast solar exposure.

The nearest permanent water source is Ten Mile Creek, 750 m north and about 15 m below the site. Intermittent streams, dry in April, are 200 m to the east and southeast. The 1963 topographic map indicates that most of the terrace was forested, with the exception of an artificial clearing in the vicinity of the site.

Three tree stumps, each rising approximately 3 m high with springboard notches about 2 m above the ground, are located in the area immediately east of the north end of the bridge. These stumps are typical of logging methods in use at the turn of the century, and probably are not contemporaneous with the site.

Feature 24

This feature is a small collapsed structure 2 x 1.9 m that may cover a depression. The debris is dimensional lumber with wire drawn nails. The function of the feature was not determined, but it appears to be associated with Features 19 and 20.

Feature 25

The last feature is a 3 x 2 m depression approximately 50 cm deep. The upper edges of the depression have been faced with 2 x 4s and a truncated beam stands upright in the middle of the depression. A 2 x 4 spans the depression east to west and is attached to the upright post. Boards cover most of the depression. The function of Feature 25 was not determined.

Interpretation

Uniformity in methods of construction, materials used and structure and feature style indicate the 25 features located at Site 24LN370 are elements of a single historic camp. The site probably was built and used in the twentieth century, almost certainly after 1920. Claim was filed on Lot 5 in 1909, although it was not patented until 1959 (Clerk and Recorder's Office, Lincoln County Courthouse:Tract Records). A camp the size of site 24LN370 probably would not have been built on the property before ownership was filed for in 1909.

Open-top tin cans were the most common nonstructural debris found at the camp. These cans have been in production since 1900, but did not gain general acceptance until 1920. The few pieces of bottle glass found were all manufactured by automatic bottling machines in production from 1920 to the present. The two clear glass bottle fragments observed are the type not produced until post-1930.

In all probability, the site was a logging camp used both as a workers' residential camp and as a work area. Logging was historically, and remains today, the largest industry in the Kootenai River valley, and is the only activity in the site vicinity that would have supported a camp of this size.

The large collapsed structures (Feature 15, 17, and 19) were almost certainly residential features, either single family dwellings or, more likely, dormitories. Feature 17 may have been a cook house, or bath house, as it apparently had both a stove and running water. All three

Feature 20

This feature is a privy, including portions of the collapsed superstructure. The privy pit is 1 x 2 m and approximately 1 m deep. A section of two-thick, lap-cut boards nailed onto a 2 x 4 frame rests upright against trees south of the pit. This section may be the privy floor, which has been torn up and set aside. Broken boards also protrude from the ground along the north edge of the pit, and miscellaneous boards are lying on the ground north of the pit. Wire drawn nails are used throughout the structure.

Feature 21

This feature is a pen or small corral approximately 2.5 x 4.2 m in size. The enclosure is formed by wiring log cross-poles to trees and presumably to upright posts. The poles are still attached to trees at the feature's southeast and northwest corners, but the posts that probably stood at the other corners are not evident. Wire that secured poles to a tree is embedded more than 20 cm into the trunk, or about half the width of the tree trunk. A small feed trough--a wooden box attached to a tree stump--is located in the southeast corner of the pen at a height suitable for cattle or horses.

Feature 22

This feature is a corduroy road that extends down a stream channel westward to the present reservoir shoreline. Remnants of the log corduroy cross-ties are visible.

Feature 23

Feature 23 is a log trestle bridge approximately 60 m long and 2.6 m wide. It spans a wide, shallow gulley. A corduroy road extends north from the bridge and connects with the Feature 18 trestle bridge approximately 30 m to the north. The road continues southward from the bridge to an undetermined location.

The bridge consists of a nine-stacked log trestle platform spanned by log stretchers. Platforms are spaced regularly at 6-7 m intervals, and are up to 2 m high. The logs used in the trestles were cut into regular 3.5 m length, then saddle-notched, and stacked in a box shape up to six logs high. The trestles are spanned by north/south running log stretchers that are saddle- or lap-notched to fit over the trestle logs. Approximately four stretchers, placed side-by-side, span the gap between trestles. Pole cross-ties are laid perpendicular to the stretchers. The ties are fastened along each edge by a north/south running pole that is nailed to the underlying stretcher.

All of the bridge trestles remain standing, but the logs are beginning to decay. The stretcher logs remain in place only on the two northernmost spans.

that have collapsed outwards. One large tin syrup container was found near the structure.

Feature 16

This feature is a partially dismantled standing structure; it is probably a privy. The structure is 2.5 x 1.6 m, and is 2.2 m high. It rests over a pit of similar horizontal dimensions, and approximately 50 cm deep. The structure has no foundation, but rests on 2 x 4s recessed into the walls of the privy pit.

The structure's walls and roof are of dimensional lumber of varying widths. Remnants of a tar paper covering are visible around nails on the roof. Wall boards are horizontal on the south side and vertical on the remaining walls. The floor is made of a double layer of planks attached with wire drawn nails. The door faces north.

Feature 17

This feature is a collapsed structure 7.8 x 8.4 m in size. The structure's floor was constructed in the manner described for Feature 15. A wall that collapsed outward in one piece, indicates that the standing structure had a gable roof and vertical plank siding. Portions of the collapsed roof have tongue and groove planking and the entire roof appears to have been covered with tar paper. An aproned opening for a stove pipe is visible in the southeast corner of the roof, and a water pipe protrudes from the ground near the structure's northwest corner. Wiredrawn nails are used throughout.

Feature 18

This feature is a collapsed log trestle bridge spanning an intermittent stream channel. A clearly visible road extends north and south of the bridge and a pile of decayed lumber is located just downhill.

Feature 19

This feature is a collapsed structure which appears to have been scavenged for wood. Several stacks of sorted lumber lie to the south and only the floor supports remain intact to define a 9 x 11.8 m area. The structure had no foundation. Rather, a rectangular frame of doubled 2 x 6s and 2 x 4s was set directly on the ground. Floor boards were then laid on top of the framework. Wiredrawn nails were used in the construction.

No debris was noted in association with the feature. However, Features 20 and 24, and possibly Feature 21, appear to be associated with Feature 19.

Feature 10

This feature may be a privy pit. It is 1.3 x 1 m and about 0.5 m deep. One large plank rests in the depression.

Feature 11

This is a small, partially intact, roofed structure of an unidentified function. The feature consists of a gable roof resting on stubby support posts; the roof sweeps the ground to either side. A plank wall is visible under the eave. The feature is built of milled dimensional lumber and wire drawn nails. Several cans are scattered nearby. They appear to be more recent than most others at the site, and have partially legible labels marked "Farmers Union".

Feature 12

The feature is a log platform 3 x 4 m in size. Two very large logs, dressed only on the upper surfaces, form the north and south walls. The logs are notched at the west end and near the east end, and a beam rests in the notches across the west end. Several milled boards lie across the log platform north to south. The ground surface inside the platform has been slightly excavated, and the backdirt piled under the beam to form the west wall. No debris is associated with the feature and its function is unknown.

Feature 13

A circular depression 3.5 m in diameter and approximately 2 m deep constitutes this feature. A board rests along the slope of the depression, and some heavy-gauge tin is partially buried in the bottom. The feature may have been a trash pit.

Feature 14

This feature is a surface dump roughly 6 x 3 m in size. The dump contains largely open-top milk cans and small and large food cans, as well as several large syrup cans.

Feature 15

This is a collapsed structure with a floor area of 11 x 4.5 m. The floor structure consists of a foundation or pad made of north/south aligned beams, with on-edge 2 x 4s laid across east to west. Floor boards overlay the 2 x 4s. The structure's roof, which is now on the floor, appears to have been a gable roof made of planks set on 2 x 4s, and covered with tar paper. Structural debris also lies to the north and west of the floor. The debris is either from walls or porch roofs

Feature 6

A small excavated rectangular depression 1.5 x .9 m and approximately 1.5 m deep represents Feature 6; it is most likely a privy pit. Several milled boards lie inside the depression. Feature 6 is spatially associated with Features 2 and 3.

Feature 7

This feature is represented by two attached board floor platforms. The overall size is 4.9 x by 8.8 m, with the west platform being 4.8 x 4.9 m and the east platform 4 x 3.9 m. The platforms consist of a foundation pad formed by two east/west alignments of 4 x 6 beams or logs, with 2 x 4s set on edge lying across the pad. Planks overlay the 2 x 4s to form the floor. As the platforms were built on an east sloping surface, they were made level by setting the west ends of the log or beam foundations on saddle-notched logs. All boards are affixed with wire drawn nails. Some collapsed boards, probably from a section of roof, remain in the central area of the platform.

Debris associated with the feature includes a stove pipe elbow, one fragment of window glass, several food and tobacco cans (machine soldered), and an iron plate, possibly from a stove. Feature 8 also appears to be associated with Feature 7.

Feature 8

This feature is a rectangular depression 1.9 x 0.6 m and approximately 1.5 m deep. It is probably a privy pit, although no structural debris is visible. Roughly 75-100 open top tin cans, including milk, food, and tobacco cans, are inside and scattered near the pit, as is a rubberized boot. All tin cans are very rusted and fragile; their labels are obscured.

Feature 9

The feature consists of a leveled area, approximately 7.6 x 3 m in size. Cutbanks mark the east and a portion of the south walls. A line of embedded cobbles probably represents a foundation for the structure's north wall. Several milled boards are scattered in the area.

Other associated debris includes a vinegar bottle (post-1930, clear glass, screw top), melted fragments of two bottles, a stove pipe elbow, a cast iron hook and chain, an automobile grill, open-top tin cans, and miscellaneous metal fragments. The remains of a small wooden foot bridge across a rill are located immediately south of the feature. Features 10 and 11 are also probably associated with Feature 9.

approximately 60 m. The westward extension is an earthen platform, covered with parallel-laid logs or poles and topped with pole cross-ties. The earthen and log/pole road is about 50 cm above the ground surface. Pits occur along the road where sediments were removed to build the platform. The road ends abruptly at a tree. It does not appear to have extended further west.

Feature 2

This feature is a cellar depression 3.5 x 3.5 m in size, and approximately 1.5 m deep. Collapsed boards obscure most of the cellar wall, but a portion of the east wall appears to be log-faced. The cellar may be associated with a collapsed structure (Feature 3) to the east.

Feature 3

This feature is the remains of a collapsed structure. The remnants are very tangled, and neither the structure's shape nor function was determined. No foundation is visible. The debris covers an area approximately 9 x 3.8 m and includes milled tongue and groove boards, 2 x 4s and other dimensional lumber with embedded wire drawn nails, tar paper, likely from the roof, and sheet tin, likely from a protective apron fitted on the roof around a stove pipe.

Feature 4

A concrete block mounting with an associated collapsed linear log and board structure constitutes Feature 4. The mounting is 0.62 x 0.62 m, it is built of concrete blocks, and threaded bolts protrude up from their tops. The 1.7 m wide linear feature extends south from the mounting for 11.5 m. wide. This feature consists of a line of undressed logs laid north/south to form a low east wall, and a line of upright milled boards partially embedded in the ground to form the west wall. The walls are approximately 50 cm high and the space between them is devoid of artifacts and structural remains. The feature served as some kind of platform.

Feature 5

This feature is a collapsed, milled board structure with wire drawn nails. The debris covers an area 9.5 x 5 m. No foundation is visible. The structure's size, shape and function could not be determined from the remains.

Roads associated with the site extend beyond its boundaries to the north and south. One of the roads extends north as far as Cripple Horse Creek. However, site boundaries were drawn at the last structural feature associated with the camp. Both to the north and south, the last structural feature was a trestle bridge associated with the corduroy roads.

Testing Rationale and Methods

Site 24LN370 was intensively surveyed, recorded and mapped in its entirety. The east/west width of the terrace, extending to approximately 130 m east of the reservoir, was surveyed in an effort to locate all features associated with the camp. The rationale for this action was that the site's interpretive value rested not with individual structures or features, but, instead, in the interrelationship of the component parts into a single functional unit. Therefore, although only a few of the site features are in immediate danger of destruction by reservoir wave action, destruction of any element of the site would diminish the interpretive value of the site as a whole.

The site area was surveyed by walking transects across the landform. When located, each feature was flagged and assigned a feature number. Next, the site landform was contour mapped and all flagged features were located and plotted on the map. Mapping was accomplished by use of a transit and stadia rod whenever possible. Distances were measured both by transit reading and by chaining. When density of vegetation prevented use of the transit, readings were taken by a hand-held Brunton compass.

Each feature located was photographed, structural characteristics were described, dimensions measured by tape, and the orientation determined by hand held compass.

Descriptive Results

In the following paragraphs, each of the site's features is described. Locations of the features are indicated on the site map (Figure 10-2).

Feature 1

This structure is a log trestle bridge, single span, built of undressed logs resting on crossbeams that are embedded in the gully bank. The partially collapsed bridge is approximately 10 m north/south by 2.5 m east/west, and it traverses a shallow gully at the far north end of the site.

Extending north/south from the bridge is a corduroy road. Remnants of log cross-ties are visible in some places. The existing corduroy road extends approximately 30 m south, then turns to the west for

Summary and Discussion

Of the 249 sites recorded in the study area, 27 exhibit only historic, nonaboriginal artifacts and an additional 55 aboriginal sites also have a historic aboriginal component. All sites with aboriginal artifacts are considered herein to be aboriginal sites for analytical purposes, whether or not they contained nonaboriginal artifacts. Those 55 aboriginal/nonaboriginal sites and the recovered historic artifacts are described in Appendix F. Twenty of the 27 historic sites have structural remains but all of those within the drawdown zone were razed prior to reservoir impoundment. Almost all of the recorded structure sites are the remains of farmsteads. Several other historic structure sites are related clearly to the logging industry. The seven historic sites without structural remains are termed historic debris scatters and probably are indicative of twentieth century trash dumping activities. Fully two-thirds of the historic sites are recorded in the Tobacco Plains zone with the remainder being in the Upper and Lower Canyon zones.

Another important fact concerning the distribution of historic sites is that all of the older--early and middle nineteenth century--documented (but not recorded on-the-ground) sites are located adjacent or near to the Kootenai River. Examples would include the trading post located near the mouth of Dodge Creek and the Catholic mission near the mouth of the Tobacco River (Chance 1981). Interestingly, the more recent--late nineteenth/early to middle twentieth centuries--sites, such as those described in the preceding subsections, occur both adjacent to the river and along the valley walls, well removed from the river channel. This shift in historic site locations probably reflects, in part, changes in economic patterns. The initial economic activities (e.g., fur trading and gold mining) focused on the river as the major means of travel and distribution of goods. Later in time, wagon roads, railroads, and finally highways served as important transportation routes. Sites indicative of farming, ranching, and logging activities tend to be spatially associated with the more recent transportation routes, which are located along the valley walls as well as in proximity to the Kootenai River. The 624 historic artifacts--tin cans, wire, nails, glass and ceramic containers, windowpane glass, etc.--recovered during the course of fieldwork were collected from 31 sites. These artifacts largely date to the late nineteenth/early-to-middle twentieth centuries. As noted, there is documentary evidence that fur trading posts and at least one mission were occupied in the early and middle nineteenth century (Chance 1981; Smith 1984), but these sites are adjacent to the Kootenai River and remained innundated during fieldwork. Consequently, the recovered artifacts and recorded sites are illustrative of the later history--farming, ranching, logging--of the Lake Koocanusa/Libby Dam area, but not of the earlier periods when fur trading and gold mining constituted major subsistence activities. The only recovered artifactual evidence for the early historic period is in the form of glass beads and copper fragments recovered from several aboriginal sites with historic components.

CHAPTER 11

SITE ANALYSIS AND SELECTED DESCRIPTIONS

by
Alston V. Thoms

Material contents of individual sites or groups of sites and their positions on the landscape are aspects of the archaeological record important in understanding land use patterns. Discussions in this chapter focus on those aspects and are directed toward a preliminary assessment of the predicted land use patterns. Descriptive data presented in Chapter 6 are expanded upon in an effort to better understand differences and similarities regarding the position of sites on the landscape, their artifact and feature assemblages and their likely chronological affiliations.

The general nature of sediments, depositional environments and chronological indications in the project area are reviewed first to set the stage for discussions of site-specific sediments and the intrasite distribution of artifacts. Next, low diversity sites are discussed and specific examples are described. High diversity sites are discussed in greater detail and a more explicit classification is presented. Selected high diversity sites also are described.

Sites are described in terms of their specific environmental setting, general nature of cultural materials, methods and rational for testing, descriptive results, and preliminary interpretations. These kinds of information are presented to provide a better understanding of the range of variability in investigative strategies, site conditions, and site contents. In several cases draft site descriptions were prepared by the crew chiefs responsible for testing the sites, and that authorship is indicated parenthetically where applicable. Otherwise sections are prepared by the author of the chapter. It should be noted that the draft site descriptions were rewritten to include the results of the 1981 field season and/or revised substantially in light of final analytical results. The last section of this chapter focuses on the distribution of site types within the project area and an assessment of their locations in relation to the predicted land use patterns.

Depositional Environments, Artifacts and Chronology

It has been emphasized that rates of sediment deposition on the higher terraces were very slow during the last 8,000 or more years and recently the upper, organic-rich deposits were removed as the lake waters fluctuated during normal reservoir operation. Under these conditions the integrity of cultural materials varies considerably but, in general, horizontal relationships among artifacts and features seem to be preserved well. Those same conditions--slow rates of deposit

coupled with postreservoir erosion--led to major difficulties in attempting to separate artifacts and features chronologically. Bioturbation (e.g., rodent activities and tree tip-ups) and cryoturbation (e.g., freezing and thawing of sediments) also have disturbed the vertical placement of artifacts.

In the absence of radiocarbon dates and chronological control available from detailed intrasite analysis, and considering the relative lack of clear stratigraphic separation of occupation surfaces, it usually is necessary to discuss site assemblages as opposed to focusing on assemblages representing cultural components or temporally restricted occupation zones. As already noted, general chronological control comes mainly from the projectile points indicative of broad time periods. Many of the dart size, wide and corner-notched projectile points, as well as the various arrow size point types found on the higher terraces are like those recovered from dated contexts at lower terrace sites. These types of projectile point types tend to be less than 3,000 years old (Roll 1982). Based on typological cross-dating there is reasonable certainty that the large, side-notched types, as well as stemmed and lanceolate forms, are considerably older, though probably not much more than 6,000 to 9,000 years old. Because only a few sites yielded point styles characteristic of only one time period (i.e., there are only a few "single component" sites) and those sites had few tools, it is difficult to define tool assemblages typical of different points in time or specific activities. For the present, then, efforts focus on defining and characterizing assemblages of artifacts recovered from different kinds of sites, and, to a more limited degree, on their general chronological affiliations.

Prior to beginning the discussion of site types, the general nature of sediments in the project area is reviewed. Sedimentary analytical units were derived and are employed as a means to describe culture bearing sediments and to facilitate intersite comparisons. Recognized analytical units represent postreservoir, prereservoir, post-Mazama (i.e., after about 6,700 years ago), and pre-Mazama deposits (see Chapter 7 for a more detailed discussion).

Stratified Lake Koocanusa deposits are referred to as LKDII. These deposits are always the uppermost unit in any sequence where they occur. LKDII sediments are well stratified and were redeposited as a result of reservoir "siltation" processes, namely the removal of sediments from one location and their subsequent deposition in another location. Particle sizes vary greatly depending upon the site's setting, but sand sizes clearly dominate. All cultural material in LKDII units is considered to be redeposited from its original, prereservoir sedimentary context.

The term LKDI refers to Lake Koocanusa disturbed sediments. LKDI deposits are basically in place, but they are analogous to plowzone sediments and in many situations represent a disturbed "A" horizon. This disturbed unit varies greatly in its age. Sometimes it represents the prereservoir surface. In other cases LKDI represents older sediments that were part of the prereservoir subsurface, but are now

near the surface because reservoir waters removed the prereservoir surficial sediments. Disturbance mechanisms include logging, and clear-cutting associated with reservoir preparation, and current and wave actions of reservoir waters. LKDI sediments always overlie some kind of intact sedimentary unit. It most commonly overlies one of the post-Mazama units. Cultural materials in the LKDI unit can be either stratigraphically in place or they can be lag deposits.

Late, post-Mazama sediments are referred to as the PMII unit. This analytical unit represents the youngest sediments that have not been disturbed appreciably by processes related to reservoir operation. In other words, it is the lower part of the near-surface natural deposits. LKDI sediments are often, in fact, a subset of the PMII analytical unit. The PMII sediments are roughly analogous to the upper part of the modern B horizon when it is represented by aeolian sands. It is estimated that sediments comprising the PMII unit were deposited during the last 2,000-4,000 years. These sediments contain considerable quantities of Mazama ash (i.e., glass shards). They are often difficult to distinguish from the PMI units.

The term PMI (early, post-Mazama) is used to refer to sediments overlying Mazama ash deposits or the lower most sediments with relatively high frequencies of Mazama glass shards. Faint iron bands are frequently characteristic of the PMI unit, which tends to be the bottom of the modern B horizon. This unit is often difficult to discern. Its estimated age is between 2,000-4,000 and 6,700 years old.

Those deposits that underlie primary Mazama ash or lack significant quantities of Mazama glass shards are termed AMII (late pre-Mazama). The AMII analytical unit is generally a B/C horizon; it is one that often encompasses thick, readily apparent iron bands and/or frost features. Its estimated age is greater than 6,700 years. The lower limiting date is undetermined, but the unit tends to overlie the deposits that represent the earliest, post-glacial, stable surfaces (i.e., the AMI unit) in the study area.

Sediments that characteristically underlie the thick iron bands are referred to as the AMI analytical unit (early, pre-Mazama). As a rule this unit represents the first or one of the earliest stable surfaces on the terraces exposed after the last major glacial episode and subsequent down cutting by the Kootenai River. AMI sediments characteristically overlie primary glacio-lacustrian deposits or bedrock.

A few review comments regarding site classification are also in order. The basic site-classification scheme was outlined earlier (see Chapter 5 and 6), but it is important to remember that originally the scheme was designed as a means to determine which sites would be tested. It was intended to provide an initial and rough measure of the range of activities represented at sites. This was accomplished by counting the number of artifact types represented at a given site and assuming that sites with many kinds of artifacts recovered and/or observed were the loci of a greater range of activities compared to sites with fewer kinds of tools. The artifact types utilized to classify sites were as

follows: (1) flakes and shatter, (2) cores, (3) edge modified flakes and cobbles (4) unifaces, (5) bifaces, (6) dart points, (7) arrow points, (8) miscellaneous hafted bifaces, (9) battered stone, (10) pecked stone, (11) ground stone, (12) incised stone, (13) fire-cracked rock, and (14) bone fragments. The appropriateness of these particular artifact types as measures of relative diversity in terms of site activities is subject to discussion, but as a heuristic device the scheme served its purposes and few would argue with the general principal that increasing diversity in artifact types is an indication of increasing diversity in activities carried out.

Low Diversity Sites

The most common kind of site in the reservoir area is represented by fire-cracked rock, varying quantities of flakes/shatter and usually fewer than five tools. For purposes of the site type classification scheme, "low diversity" sites are those that yielded six or fewer kinds of artifacts, including at least one kind of flaked or nonflaked lithic. Several of these sites were test excavated and some of those are described here. Three other kinds of sites--fire-cracked rock and bone sites, debitage only sites, and fire-cracked rock only sites (see Chapter 6)--are considered to be subsets of a more general low diversity site type. On the whole, these sites probably represent short-term occupation sites where a comparatively (i.e., in relation to high diversity sites) limited range of activities are represented. Of the 195 aboriginal sites with enough information available to classify as high diversity or generalized low diversity, or some other type (e.g., rock art, and rock alignment) a total of 161 (82.6%) are in the low diversity group. These sites tend to be small (i.e., less than 1,000 m^3) in size. Although found throughout the project area, most of them are located in the Tobacco Plains zone. Projectile points and thin edge modified tools are best represented at these sites, but nonflaked lithic tools and thick, flaked tools occur frequently. There are 24 low diversity sites with identified projectile points. Those considered representative of the Early/early Middle, late Middle, and Late Prehistoric periods occur in similar numbers (i.e., 10-11) of sites. However, eight of the 10 Late Prehistoric Period sites are "single component," whereas only 3 of the 10 sites with Early/early Middle projectile points and 3 of the 11 sites with late Middle points are "single component" sites.

The sites described in the following subsection represent the range of low diversity sites in terms of their chronological associations and to a lesser extent, their contents. The various depositional environments also are represented to some extent. Sites in clusters are included in the descriptions as are the more isolated sites. Additional information about low diversity sites is to be provided in the various tables that are part of Chapter 6 and in Appendix C.

Sophie Creek Culvert Cluster

This cluster of sites is located in the central portion of Kootenai Flats on a large sand dune. Its name stems from the fact that the sites are located immediately north of a culvert or small bridge over Sophie Creek. The low dune contains the remains of five low diversity sites--24LN427, 24LN429, 24LN690, 24LN691, and 24LN1144--separated by relatively smaller areas devoid of cultural materials (Figure 11-1). Clearly, it would have been possible to consider all of these sites as one large site with several areas of artifact concentrations. However, because the sites were recorded as a result of several surveys, beginning in the early 1970s, the previous designations were maintained and new sites were added during the 1982 season.

The large, but low dune, referred to as the Sophie Creek Dune, lies within the Kootenai Flats portion of the northern or Tobacco Plains zone. Judging on the basis of prereservoir aerial photographs and the density of tree stumps, Kootenai Flats can be characterized as an open coniferous forest area with a good grass cover. Kootenai Flats is dominated by a series of sand dunes. Only Sophie Creek and the Kootenai River provide permanent water supplies.

All of the sites in the Sophie Creek Cluster are within 100 m of a permanent water supply. Sophie Creek flows along the east and southern margins of the low dune. Because there are no higher landforms in immediate proximity to the dune and because the area to the south and west is considerably lower in elevation, all of the sites can be considered to have full southern solar exposures. As would be expected sediments are sandy; gravels are not part of the natural sedimentary matrix. Elevations for sites in this cluster range from 2,360 to 2,400 ft (ca. 719-731 m) amsl.

In addition to extensive occupation by aboriginal groups, Sophie Creek dune also was occupied during much of the historic period. At least three historic farmsteads once stood on the dune or in immediate proximity. These structures were razed prior to reservoir impoundment. Surface modifications undoubtedly occurred earlier in conjunction with construction and maintenance activities for the farmsteads. Thus, some parts of the dune, particularly the southern end, have been disturbed extensively if not intensively.

24LN427 (Sheila J. Bobalik)

Site 24LN427 is at an elevation of 2,370 feet (722 m) and lies on the south-central part of the dune (Figure 11-1). Sophie Creek is less than 5 m below and approximately 10 m east of the site. In some areas of this site, especially on the dune slopes, tree roots are exposed 10-20 cm above the surface, indicating significant erosion has occurred. Tree stumps are partially buried near the crest of the dune by postreservoir sediments.

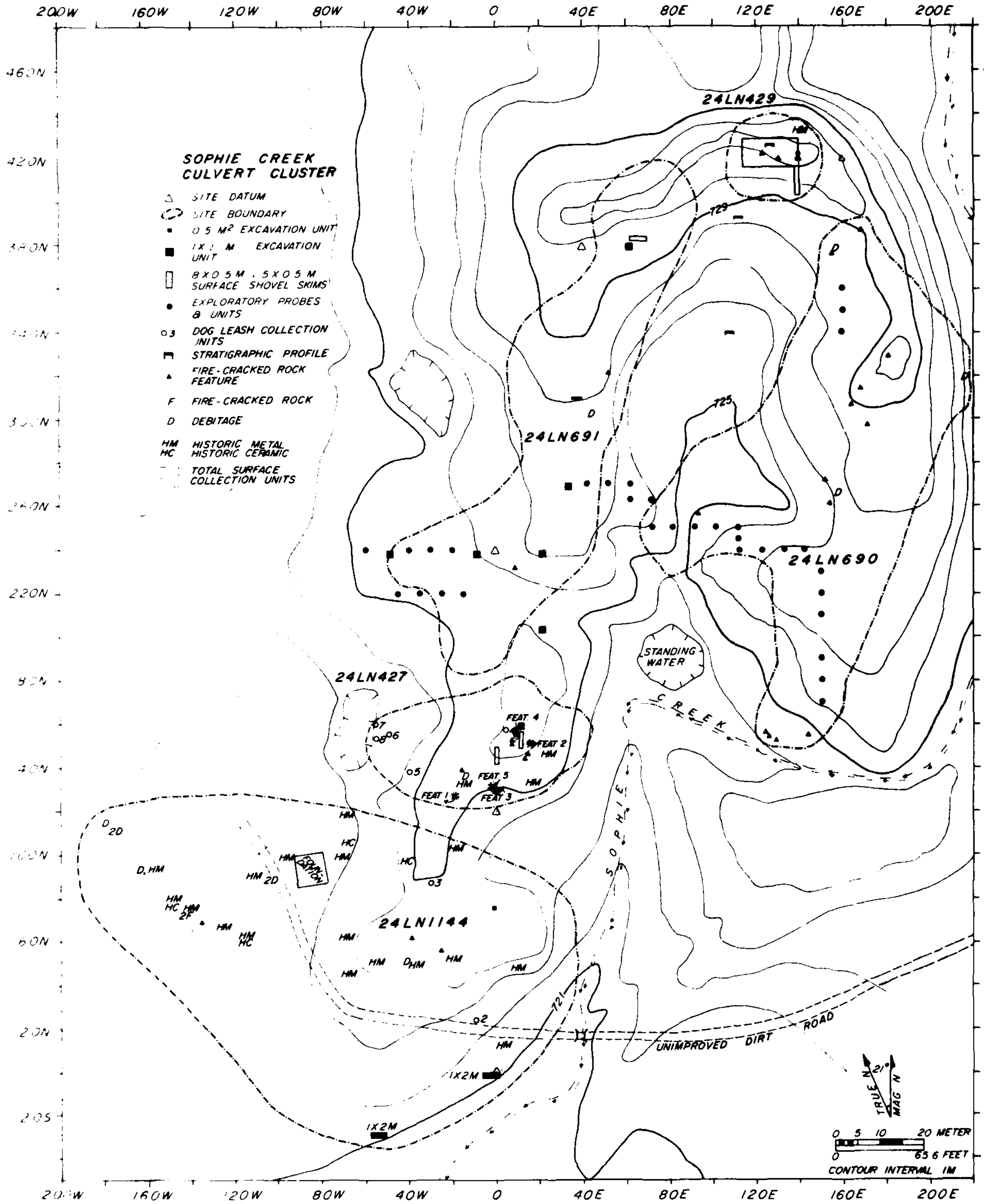


Figure 11-1. Map of the Sophie Creek Culvert site cluster showing the location of three low diversity sites: 24LN427, 24LN1144, and 24LN429.

Cultural remains were scattered across a 120 x 90 m area, but tended to be most obvious on the top of the dune ridge. Flakes, shatter, burned and unburned bone, isolated FCR, and a few historic items were observed. Numerous FCR features and two concentrations of burned bone bits and flakes were observed on the surface. Most of the FCR features occurred on the dune ridge, but the most intact one and both of the burned bone/flake features were observed on the gentle dune slope. Scattered FCR densities ranged from medium on the dune ridge to low for the rest of the site area. An unmodified cobble also was observed. The chipped stone artifacts included a variety of material types. Historic artifacts were observed primarily on the western dune slope. These items included tin can fragments, green and clear bottle glass, a metal pan, a barrel hoop fragment, and unidentified metal fragments.

Much of the dune was covered by 3-15 cm of postreservoir (LKDII), very fine sands (Figure 7-10). LKDI sediments that include wood charcoal and burned pine needles varied between 2 and 10 cm in thickness. Approximately 50 cm of PMII deposits were examined. Bioturbation was evident in these well sorted aeolian deposits. Cultural remains were recovered from the upper 20-30 cm, primarily from LKDII or LKDI sediments. However, some materials were recovered from the PMII unit.

During a systematic survey of the site area, cultural materials were marked with color-coded wire flags. Proveniences of select flaked lithics, bone, and historic artifacts were recorded from known grid stakes. Only flaked lithic tools and potentially identifiable bones were collected. The density of isolated FCR was recorded for each 20 x 20 m grid unit.

Provenience, number of items, material type, associated artifacts, and diameter were recorded for eight disturbed features. The three FCR features that appeared more intact and both bone/flake clusters were assigned specific feature numbers. These five features were partially excavated in order to assess integrity and recover associated artifacts.

Subsurface investigations included the excavation of five 1 x .5 m units, a .5 x .5 m unit, and two 8 x .5 m shovel skim units. Four liter constant volume waterscreen samples were collected from each 10 cm level of the .5 x .5 m and all 1 x .5 m units. In addition, a constant volume sample was collected from all eight segments of one shovel skim unit.

The .5 x .5 m unit was located near the dune crest which appeared fairly intact. This unit was terminated at 50 cm after three sterile levels. A 1 x .5 m unit bisected Feature 1, the most intact FCR concentration. This unit was terminated at 30 cm after excavating below the feature. Features 2 and 4 were bisected with 1 x .5 m units. The unit placed across Feature 2 was terminated at 30 cm below surface and the one that bisected Feature 4 was stopped at 40 cm, after three sterile levels. Similar exploratory excavation units were placed over the small bone/flake concentrations designated Features 3 and 5.

Given the general paucity of small size surface artifacts, there was some concern that postreservoir deposits were masking the artifact variability at this site. To determine the nature of artifact variability just beneath the surface, two north/south 8 x .5 m shovel skim units were excavated. The first was placed on the slightly eroded southern slope of the dune and the second one was located on the fairly intact crest of the dune. Each unit was dug as eight 1 x .5 m segments. Each segment was dug through the LKDII sediments until the PMII unit was observed. As a result, the depth of the shovel skim segments varied between 4 and 21 cm. Although artifacts were encountered, they were similar to those on the surface.

As discussed above, 11 FCR and 2 bone/flake features were observed at 24LN427. The eight FCR features that received only surface documentation each consisted of 8-30 FCR within a 1-2 m^2 area. No other artifacts were observed in association with these features. Quartzite was the only FCR material in six of the features, but the other two had both quartzite and argillite.

In planview Feature 1 showed approximately 11 quartzite FCR and two tiny burned bone fragments within an area 60 cm in diameter. Unlike the other FCR features excavated at this site, an oxidized matrix was directly associated with Feature 1. In cross section, this oxidized stain was a basin shaped pit which measured 65 cm at the top. This pit was first observed at a depth of 2 cm and continued to 14 cm below ground surface. A total of 33 very small (ca. less than 1 cm in size) burned bone fragments and FCR were recovered in levels 1 (0-10 cm) and 2 (10-20 cm) from the matrix (i.e., oxidized sediments). Materials suitable for radiocarbon dating were not recovered in sufficient quantities.

On the surface, Feature 2 consisted of nine quartzite FCR within a 1 m^2 area. Most of the material was restricted to the surface; only three FCR were recovered from levels 1 and 2. No other artifacts were recovered. There was no evidence of an oxidized matrix or of pit stratigraphy.

Feature 3 consisted of 48 small bone fragments and two small flakes clustered within a 1 m^2 area. Although a few bone fragments were recovered to a depth of 30 cm below surface, these were associated with a large, burned tree root. No other materials were obtained from Feature 3.

In surface planview, Feature 4 had approximately 10 quartzite FCR scattered across an area 1.1 m in diameter. Two small burned bone fragments and 15 FCR were recovered between 0 and 10 cm below surface. There was no evidence of pit stratigraphy or oxidized sediments associated with this feature.

On the surface, Feature 5 consisted of numerous very small, burned bone fragments and a few small flakes scattered over a 1.5 m^2 area. A total of 141 burned bones including three fish vertebrae identified as Salmonidae (probably trout), nearly 20 FCR, a flake, and a tiny blue

glass "seed" bead were collected from level 1. A single flake was recovered between 10 and 20 cm below surface. No evidence for a pit stratigraphy was observed.

A limited quantity of small flakes, FCR, and burned bones was collected from the .5 x .5 m unit, primarily from the waterscreen samples. FCR and burned bones were recovered from three of the 1 x .5 m segments of the shovel skim unit located on the southern dune slope. A variety of artifacts were recovered from all eight segments of the other shovel skim unit. These included FCR, flakes, burned bone, and glass "seed" beads. Much of this material came from the waterscreen samples.

The unmodified quartzite cobble was approximately 20 cm in diameter. This was the only artifact of this type reported for the site. It was observed approximately 5 m from a small FCR feature. Recovered chipped stone artifacts included 20 flakes, one of which was obsidian, as well as shatter, a notched pebble, and several beads (Table 11-1).

Of the 391 faunal remains collected from this site, the majority (229, 57.3%) come from four features. The bone material from these features has been burned (95.5%) and is of small size (less than 2 cm) (97.8%). The other faunal material includes three shell fragments, a fish bone, two bird bones, and two very small mammal (i.e., rodent) bones that are nonarchaeological. The cow bones, and a fragment of saw-cut cancellous bone probably are associated with the historic occupation of the site. The remaining bone material is very similar to that from the features.

Historic period aboriginal occupation sometime after 1860 is suggested by the glass "seed" beads (David Chance 1982; personal communication). The FCR features, burned bones, and chipped stone artifacts are associated with this or an earlier aboriginal use of the site area. The site could well have been occupied during any season of the year given its proximity to permanent water and its ideal solar exposure. However, since trout make their runs in the spring to fall it is not likely to be a winter site. The presence of a basin shaped shaped hearth without fire-cracked rock suggests that the feature, if not the site, was used at a time of year when sediments were dry. This coupled with burned trout vetebrae is indicative of a dry season occupation, perhaps sometime from the late spring to early fall.

The limited quantity and variety of artifacts and features indicate short-term utilization of the site. Suggested activities include meat and/or bone processing, cooking and lithic reduction. The presence of fish bone and the notched pebble indicate fishing. The early part of the lithic reduction sequence is represented, as evidenced by the presence of numerous corticated mudstone flakes. However, most other flakes are small and lack cortex, suggesting the later end of tool manufacturing and/or refurbishing. Feature 1 appears to have been a hearth. Features 2 and 4 and several of the unexcavated FCR features may also represent hearths or they could be the remains of cooking activities associated with stone boiling. Features 3 and 5 probably are bone refuse piles/concentrations.

Table 11-1. Inventory of Recovered Tools and Byproducts from Site 24LN427.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	2	8.00
Quartzite Flakes/Chips	6	24.00
Chert Flakes/Chips	2	8.00
Other, Small Flakes/Chips	11	44.00
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	3	12.00
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	-	-
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	1	4.00
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	25	100.00

Site 24LN1144

This site is located on the most disturbed part of the sand dune and it contains the remains of a modern concrete house foundation. Local residents indicated that a machine shed or workshop once stood within the confines of 24LN1144. Relic collectors, working with metal detectors, have dug numerous pot holes in the site. Some 10 to 20 cm of sediments have been eroded from the higher parts of the site, and near the southern end there has been as much as 30 cm of postreservoir deposition. Elevation ranges from 2,365 to 2,375 ft amsl.

Aboriginal and historic cultural materials are scattered over an area of approximately 9,900 m^2 (Figure 11-1). A low density of flakes, and FCR occurs over most of the area, particularly the northern and central parts of the site. These areas also contain most of the historic debris, including unweathered bone fragments, ceramic fragments, cooking pans, bottle glass, tin cans, barbed wire, and machinery (e.g., plow) parts. Historic features include the house foundation and several concentrations of metal artifacts. Aboriginal features are limited to three FCR concentrations.

An exploratory test unit in the northern part of the site revealed that the upper 15 cm of sediments were LKD deposits, underlain by 150 cm of PMII deposits. Cultural materials were confined to the upper 40 cm, but few items were recovered from relatively undisturbed PMII sediments. The test pits placed at the southern end of the site, near Sophie Creek revealed the presence of historically disturbed sediments. In those units, the upper 10 cm were LKDII sediments, underlain by 15 cm of organic rich sediments (LKDI) containing aboriginal and historic artifacts. This organic rich, dark colored unit appeared to be a disturbed "A" horizon. Some of these organic rich sediments were high in clay and silt size particles; they probably originated near Sophie Creek. Other sediments appeared to be disturbed PMII deposits; these probably originated upslope and may have been displaced partially as a result of construction related activities. Relatively undisturbed PMII deposits were encountered beneath LKDI sediments and continued to a depth of 60 cm below surface.

Testing activities conducted during the 1981 season were designed primarily to determine whether or not cultural materials were present in subsurface deposits. The second season's work was directed toward documenting the nature of surface artifact distributions. Considering that a number of items were recovered during the first season, only identifiable faunal remains were collected from the surface during the 1982 season. The locations of all recorded items were plotted on the site map (i.e., the site cluster map, Figure 11-1).

Cultural materials from this site were recovered primarily from LKD sediments and from the upper portion of PMII sediments to a depth of about 50 cm below surface. The most obvious surface artifacts are those readily attributable to twentieth century farm/ranch economic and domestic activities. Several of the subsurface probes and test units also yielded historic material, mainly glass and metal fragments.

The types of lithic artifacts attributable to aboriginal groups were limited to a single thick biface, edge modified flakes and unmodified flakes and chips (Table 11-2). As with most sites in the area, mudstone was the most common raw material type, although several red, translucent chert flakes were recovered as were quartzite flakes and chips. In addition to the flaked lithics, the site also exhibited several larger (10-20 cm diameter), unaltered cobbles that may have served as "furniture rock" for the aboriginal inhabitants. However, the unaltered cobbles could be part of the nonaboriginal, Historic Period assemblage.

The three FCR concentrations on the site's surface each had from 4 to 23 pieces of FCR within a $1m^2$ area. These were carefully examined for other kinds of cultural materials, but none was observed.

Faunal material from 24LN1144 included 44 bone fragments. Several of these, including two bird bones, three pocket gopher bones, a dog bone, and a sheep bone, probably not associated with the aboriginal occupation. Two weathered long bone shaft fragments from a deer size mammal exhibit cut marks and can be assigned to the aboriginal occupation with reasonable certainty. The remaining specimens are small fragments (less than 2 cm) and almost half (45.4%) of them have been burned as is typical of bone from aboriginal sites throughout the study area.

It is apparent that the twentieth century (ca. 1910-1970) farmstead activities, coupled with those related to reservoir impoundment and operation, caused considerable damage to the aboriginal materials at 24LN1144. In addition, the site and adjacent areas have been subjected to intensive relic collector activities. Information derived from test units indicate that as much as the upper 40 cm of deposits have been disturbed. With the possible exceptions of the two larger surface FCR features and the few artifacts (flakes/chips and FCR) recovered from the uppermost portion of the PMII sediments, the aboriginal materials is not considered to be in situ.

The kinds of aboriginal materials observed at or recovered from the site are indicative of short-term occupation(s) by relatively small groups of individuals. The limited range of tool types recovered from the site coupled with the presence of burned faunal remains suggests that groups were involved in hunting related activities. The site could have been occupied at any time of the year. There is little at the site to indicate temporal affiliations other than the fact that the sand dune itself is probably less than 6,700 years old as evidenced by a lack of Mazama ash deposits and paleosols. Two factors may be considered as tentative evidence for a later Period occupation: (1) 24LN1144 is in immediate proximity to 24LN427, a Historic Period aboriginal site; and (2) several flakes from 24LN1144 are red, translucent chert , which tends to be more common at Late Prehistoric Period sites. Collectively these data are employed to suggest that 24LN1144 probably was occupied during the Late Prehistoric and/or Historic periods.

Table 11-2. Inventory of Recovered Tools and Byproducts from 24LN1144.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	81	74.31
Quartzite Flakes/Chips	15	13.76
Chert Flakes/Chips	9	8.26
Other, Small Flakes/Chips	-	-
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	1	0.92
Shatter	-	-
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	3	2.75
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	109	100.00

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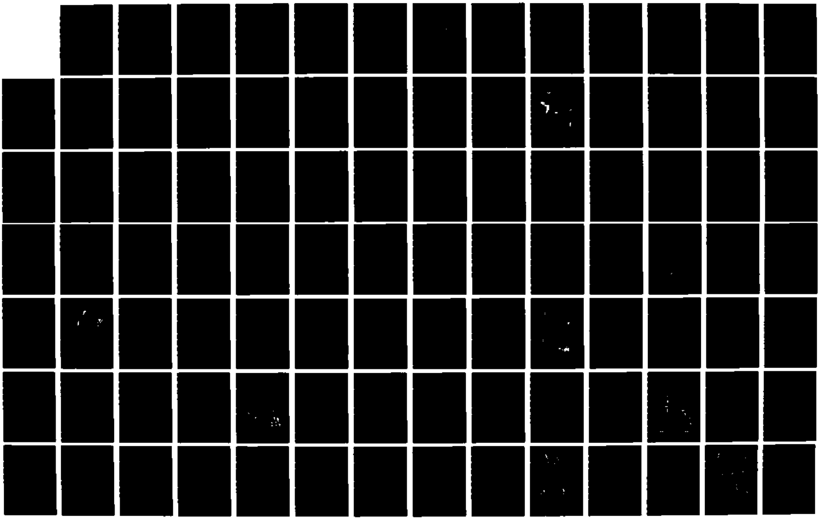

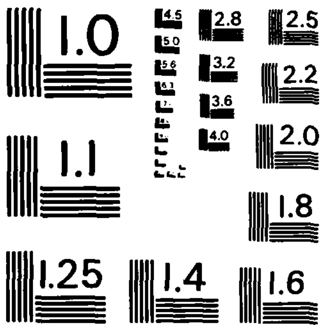
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4.5
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2.8
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3.2
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3.6
4.0
2.0
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1.8
1.25
1.4
1.6

Site 24LN429

This small site is located on the northeast corner or the highest part of Sophie Creek Dune (Figure 11-1). Because 24LN429 is situated on the highest part of the dune, it has been subjected to considerable postreservoir erosion. As much as 50 cm of sediments have been eroded from parts of the site; most portions of the site have lost from 10 to 20 cm of sediments. The site also has witnessed a good deal of off-road vehicle traffic and relic collecting.

Elevation at the site ranges from 2,390 to 2,400 ft amsl. Sophie Creek passes within 40 horizontal and 5 vertical m of the site.

Large quantities of flaked lithics, primarily debitage, and lesser amounts of FCR were present within an area approximately 2,500 m^2 in size. Most of the material was concentrated in the central portion of the site where distinct FCR features were apparent. In addition to flaked lithics and FCR, fragments of bone and a few unaltered cobbles were observed. Only one historic artifact--a metal bucket--was found on the surface of this site.

Most of the site is covered with a thin mantle of LKDII sediments. Limited subsurface probes revealed that LKDI sediments extended to a depth of 10-20 cm below surface and were underlain by well sorted fine grain sandy sediments (i.e., PMII) to a depth of at least 2 m.

Site 24LN429 was one of those selected for intensive surface collection by grid units during the 1981 season. It was chosen for comparative purposes as one of the Tobacco Plains or northern zone sites that yielded substantial quantities of lithic artifacts other than FCR. The entire site area was collected by 2 x 2 m grid units. Because it was obvious that many artifacts were very small and obscured by LKDII sediments, each of the 2 x 2 m units was shovel skimmed to 5 cm below surface and the sediments were screened through a fine wire mesh (i.e., window screen). Fire-cracked rock was counted, weighed, and discarded in the field. All other artifacts were collected.

A single exploratory probe (i.e., a shovel test) was dug near the center of the site in 1981 as a means of determining the nature of subsurface deposits. During the 1982 season a soil auger was used to assess the nature of subsurface deposits. The objective was to gather information useful in determining whether or not paleosols and/or volcanic ash were present at depths well below the contemporary surface.

Numerous flakes and FCR, including one FCR feature, were observed during the 1982 season. FCR was far more common than flakes, with the former occurring in moderate densities and the latter being present in low densities. Collections were not made in 1982, because the kinds of materials observed were virtually identical to those recovered in 1981.

Cultural materials at this site were confined primarily to the upper LKD sediments. Artifacts were not recovered from the exploratory probes, but after shovel skimming it was apparent that at least some of

the FCR extended into the PMII deposits. A total of 1,028 flakes and chips and one piece of shatter were recovered from 43, 2 x 2 m grid units. Also, one thin edge modified flake made from a black translucent chert, and fragments of three mudstone projectile points (two proximal ends and one distal tip) were recovered from the site (Table 11-3). The only other artifact recovered was an unmodified fossiliferous mudstone cobble. The two projectile points, complete enough for classification, were large, "eared", indented base points.

The vast majority (93.7%) of the flakes and chips were mudstone and well over half of these were less than 1 cm in maximum dimensions. Most of the chert flakes and chips were also very small in size. Red to brown was the most common color for translucent chert, followed by the grey to black translucent material. Large mudstone flakes with cortex were present, but rare. Most of the flakes and chips, including almost all of the chert specimens appear to have been detached during biface manufacturing processes. Quartzite flakes were also comparatively rare, and they too tended to be small in size.

Scattered FCR densities were high, but not nearly so high as were flaked lithics. Two discrete FCR features were apparent in the central portion of the site and one of these appeared to extend into the relatively intact PMII sediments. Both of these features contained a few small bone fragments. The third FCR feature was located in the southeast part of the site; it did not contain readily observable bone fragments. The FCR feature that extended into PMII sediments was exposed on the surface during the 1982 season. About half of the 33 pieces of FCR remaining in this feature (following surface skimming in 1981) were quartzite and the others were sedimentary rocks.

A total of 128 bone fragments was recovered from the grid units. Almost all of these were either extensively weathered and/or burned; as such they are considered to be related to the aboriginal occupation. Most of the bone fragments were small in size and burned, but identifiable fragments included the remains of deer and rabbits. Several fish bones were also collected from the site, but none were weathered and all appeared to be recent "natural" occurring bones that would be expected in a reservoir drawdown zone.

Site 24LN429 is one of the few sites in the sample that yielded large quantities of chipped stone debitage and relatively few tools. Interestingly, the vast majority of the mudstone flakes and chips represent the same kind of raw material used to manufacture the two large, "eared," indented base projectile points. The facts that most debitage is represented by small, biface thinning flakes, that large corticated flakes are very rare and that cores are absent, lead to the suggestion that the final stages of biface manufacture and probably some maintenance of extant tools occurred at 24LN429. However, as evidenced by the presence of burned bone bits and FCR, other activities also are represented. Obviously, these materials are indicative of hunting related activities, perhaps final processing and consumption of game animals. In general, the very limited range of tool types supports the contention that hunting related activities are best represented at this site.

Table 11-3. Inventory of Recovered Tools and Byproducts from Site 24LN429.

Artifact Type (Morpho/Technological)	Quantity Absolute	Quantity Relative
Mudstone Flakes/Chips	968	93.71
Quartzite Flakes/Chips	15	1.45
Chert Flakes/Chips	31	3.00
Other, Small Flakes/Chips	14	1.36
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	1	0.10
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	1	0.10
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	2	0.19
Dart Size Fragments	1	0.10
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	1,033	100.00

The density of scattered FCR, together with the proximity of several FCR features, is suggestive of multiple occupation by small groups of people. An early Middle Period occupation is indicated by two dart size projectile points. A later period occupation may also be represented. This latter suggestion is made because of the presence of numerous small, probably pressure flakes, made from translucent grey to black and tan to red cherts. These materials are most characteristic of the late Middle, and Late Prehistoric periods. Later period utilization of the site area would be expected, considering 24LN427 and possibly 24LN1144 were occupied during those times. Furthermore, local relic collectors report recovery of arrow size projectile points from various localities on Sophie Creek Dune.

While 24LN429 could have been occupied at any time of the year, there is some indication that it may have been occupied during part of the wet season. This suggestion is made because only half of the FCR is quartzite or the material used most commonly for stone boiling. In other words, about half the FCR observed at the site was nonquartzite (primarily sedimentary rocks with many bedding planes) or the type of rock that would be expected to be more useful for lining hearths as a means to reduce heat loss. Of course, quartzite is also useful as hearth lining material. Given the argument that much of the FCR appears to be related to hearth stones as opposed to boiling stones and considering that faunal remains are relatively common, it is suggested that the principal occupation(s) of 24LN429 occurred during late winter or early spring when game animals probably were readily available in proximity to the site.

Site 24LN704 (Lynne MacDonald)

This low diversity site is located on the east side of the reservoir between the Tobacco River and Pinkham Creek (Figure 6-1). It is one of the Tobacco Plains sites situated adjacent to, but above the high water level of Lake Koocanusa. The site is located on the end of a dune landform that slopes toward the reservoir. It has a southwestern solar exposure. Vegetation consists of scattered pine trees, low brush, and good grass cover. The northern part of the dune is also the locus of historic site 24LN1082, but the standing log structure and the sediments that supported it in 1976 have eroded and presumably fallen into Lake Koocanusa. An intermittent tributary located about 175 m to the south provides water seasonally, but the Kootenai River channel, located about 835 m to the west is the nearest permanent water source.

General Nature of Cultural Materials

Cultural material consisted of a few flakes and fire-cracked rock and one battered cobble in and adjacent to the road cut (Figure 11-2). Historic debris was scattered over the lower slope of the site. Scattered fragments of a broken soda pop bottle were found along the road cut, part of a 50 gallon drum rested on the lower slope, and a barn

door was found below the cutbank west of the site. These items probably are the remains of 24LN1082.

Stratigraphy

The relationship between the age of sedimentary deposits and cultural materials at this site is a complex one and is discussed in Chapter 7 (Figure 7-10). Here, a brief review is sufficient. Within the site area, on the lower point and slope of the dune, the sedimentary deposits consisted of post-Mazama aeolian sands from ground surface to between 50 and 70 cm below surface followed by AMII aeolian sands to the base of the units. Redeposited Mazama ash separates the pre- and post-Mazama deposits. East of the site area on the crest of the dune, PMII sediments were preceded by PMI at 40-80 cm below ground surface. It appears as if the redeposition of Mazama ash deposits followed an erosional event that removed the post-Mazama sediments. Occupation of the landform began after that erosional event and may have continued for some time thereafter.

Testing Rationale and Methods

Testing procedures at site 24LN704 included point proveniencing and collecting all visible material, excluding the historic debris. Four excavation units and three exploratory probes were dug at the site (Figure 11-2). Three 1 x 2 m excavation units were located on the high part of the dune. These units were excavated to assess the depth and nature of the cultural deposit. They were excavated 30 cm below the last cultural material, in these cases to between 110 and 140 cm below surface.

The fourth excavation unit, a 1 x 1 m unit, was located on the lower flat at the westernmost end of the landform. This unit, and the eight post holes or small excavation units placed to the north of the known site area, were used to determine horizontal extent of the cultural deposits.

Descriptive Results

More than 1000 flakes/chips and over 100 shatter fragments were recovered from the three 1 x 2 m test units (Table 11-4). In all three units, the bulk of the cultural material was recovered from a 10-20 cm thick deposit that was at the base of the PMII stratum and/or at the top of the AMII stratum. The same kinds of raw material types and, in general, the same kinds of flakes were recovered in roughly the same proportions from the PMII and AMII deposits. The actual depth of the dense material deposit varied between test units.

In two test units (107N/102E; 104N/105E) the dense artifact deposit was in association with a probable paleosol. In unit 112N/107E, the probable paleosol was not noted, but the denser cultural stratum

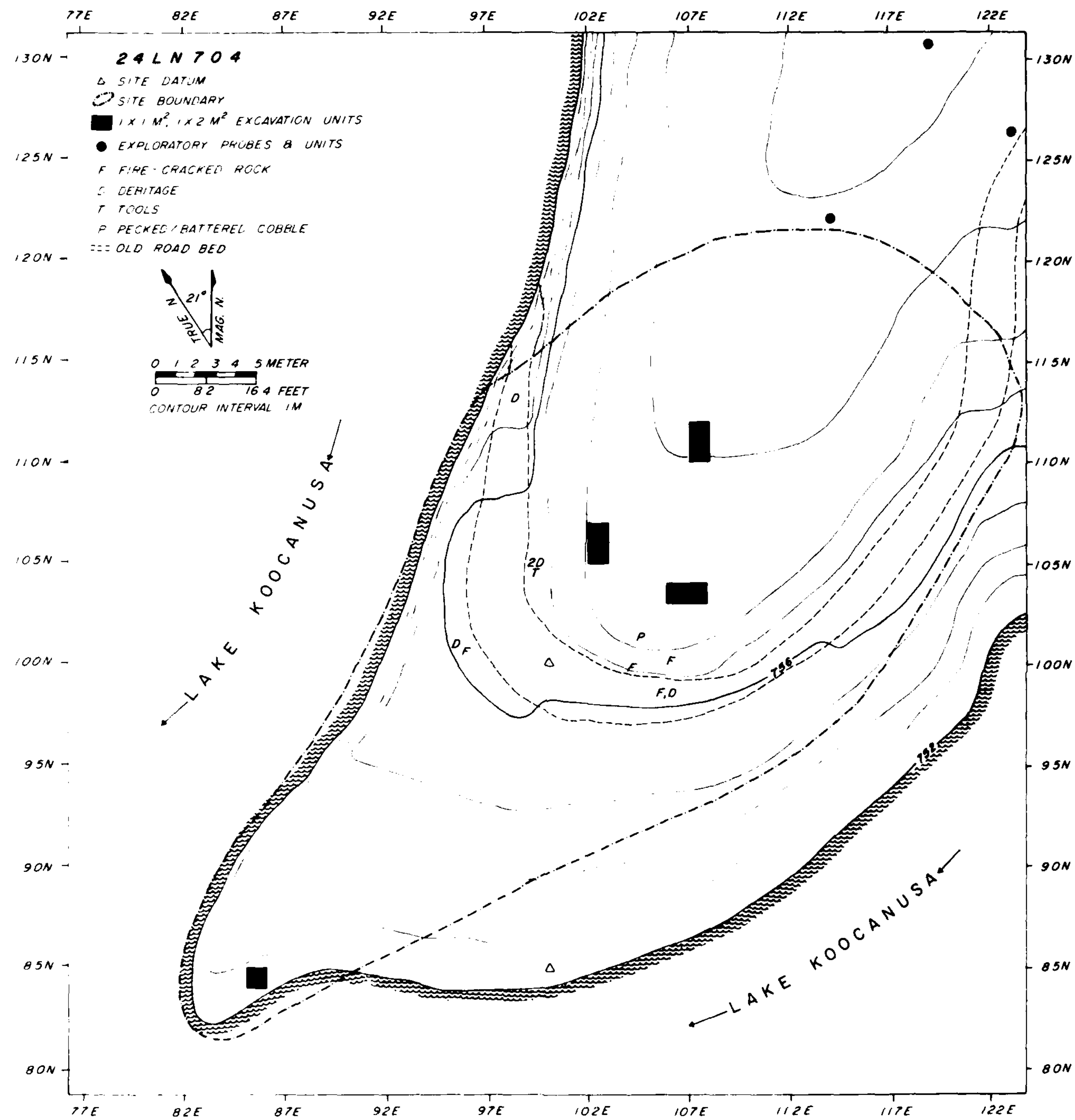


Figure 11-2. Map of 24LN704, a low diversity site.

Table 11-4. Inventory of Recovered Tools and Byproducts from Site 24LN704.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	663	55.20
Quartzite Flakes/Chips	88	7.33
Chert Flakes/Chips	133	11.07
Other, Small Flakes/Chips	203	16.90
Cobble Cores	1	0.08
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	1	0.08
Shatter	107	8.91
Biface III	-	-
Biface IV	1	0.08
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	4	0.33
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	1,201	100.00

originated just below a Mazama ash mottled stratum. Flecks of a similar ash also were present approximately 10 cm above the dense artifact deposit in unit 107N/102E. The sediments from which artifacts were recovered had high frequencies of Mazama glass shards.

As mentioned earlier, unmodified lithic debris was the principal cultural material. One chert Biface IV, probably a projectile point preform, a Biface I fragment, and a mudstone core fragment were recovered, as were four thin edge modified flakes, three of mudstone and the fourth of chert. Some FCR was recovered below surface; four pieces were found in the dense flake stratum in unit 112N/107E. One unmodified cobble was recovered from just below surface in 104N/105E. The 1 x 1 m unit excavated at the southwest end of the site yielded a single FCR and no flaked lithic material. The postholes excavated to the northeast across the crest of the dune produced no cultural material.

Interpretation

Temporally diagnostic artifacts were not recovered from the site, and sedimentary associations indicate only that occupation began sometime after 6,700 years ago. If the Biface IV is indeed a projectile point preform, then the resulting point would have been a small dart size or a large arrow size point. This tends to suggest a date sometime after 4,000 years ago.

Flaked lithic tool manufacture appears to have been an important activity and the range of debris indicates all stages of reduction occurred at the site. The presence of the FCR and the edge modified flakes indicate other activities took place. The FCR probably indicates food preparation, while the tools imply that light-duty cutting and scraping activities occurred.

The hundreds of flakes and chips could represent no more than a brief episode of tool manufacturing and reconditioning. Site 24LN704 probably represents a very few, if not a single occupation, as indicated by the uniformity of debris types and the horizontal and vertical clustering of material. Lack of readily available water, other than from the intermittent stream to the south, may indicate a winter or early spring occupation. However, occupation could have been of such a short duration as to preclude the necessity of having immediate access to a water source.

Site 24LN677 (Lynne MacDonald)

Site 24LN677 is located on two small knolls on a larger sand dune near the middle of Kootenai Flats in the Tobacco Plains zone. Its elevation is 2,400 feet. The dune slopes gradually to the south and joins with other dune ridges to the west and south. To the north, the dune is bisected by a minor intermittent stream channel. Beyond the stream channel is a notable topographic low. The nearest permanent water source is Sophie Creek, about 1 km to the southwest. The site has

a west to northwest solar exposure. The 1963 topographic map indicates that the site area was forested. Several stumps remain with 20-30 cm of their roots exposed, demonstrate that significant postreservoir surface erosion has taken place on part of the site.

General Nature of Cultural Materials

Cultural material exposed on the surface consisted primarily of small bits of burned bone and flakes, with an occasional fire-cracked rock scattered over a 2,700 m^2 area. The majority of the material was concentrated on the northern most knoll of the dune in an area approximately 20 x 20 m (Figure 11-3). Bone was scattered over the surface of the concentration area, increasing in density toward the south. A dense concentration of small fragments or bits of burned bone occurred in a circular area approximately 1.5 m^2 in the south-central part of the site. Quartzite, mudstone, and chert flakes were more densely concentrated in that area.

One small FCR feature was located at the north end of the site just beyond the area of bone concentrations. A moderately dense (4-9 pieces/400 m^2) scatter of FCR occurred over the site surface. A small linear concentration of bone bits and flakes also occurred across the north end of the east part of the site. Otherwise, a thin general scatter of bone bits with an occasional flake occurred over the entire site surface. Recent historic items, including bottle glass and shotgun shell casings, were scattered along the east edge of the landform.

Stratigraphy

Site sediments consisted of PMII fine sand deposits overlain by a 10-20 cm thick LKDI unit. LKDII deposits were found only in the east portion of the site. Little deposition (i.e., less than 20 cm) appears to have occurred subsequent to the site's occupation and before reservoir inundation. Cultural materials were confined to LKD and PMII deposits. The stratigraphic profile at 24LN677 is much like the one for the Sophie Creek Dune (see Figure 7-10)..

Testing Rationale and Methods

Surface monitoring and recovery activities consisted of surface collecting and excavating three lines of shallow shovel skim trenches (Figure 11-3). Flaked lithic artifacts were point provenienced, then a 1.15 m radius circle scribed around that point and all cultural material inside the circle was collected. Ultimately, all surface visible lithic debris as well as a sample of the surface bone was collected. In each line of shovel skims, every other 1 x .5 m unit was excavated. Units were excavated either to contact with intact, culture bearing sediments, or below the LKDII to an arbitrary 10 cm depth.

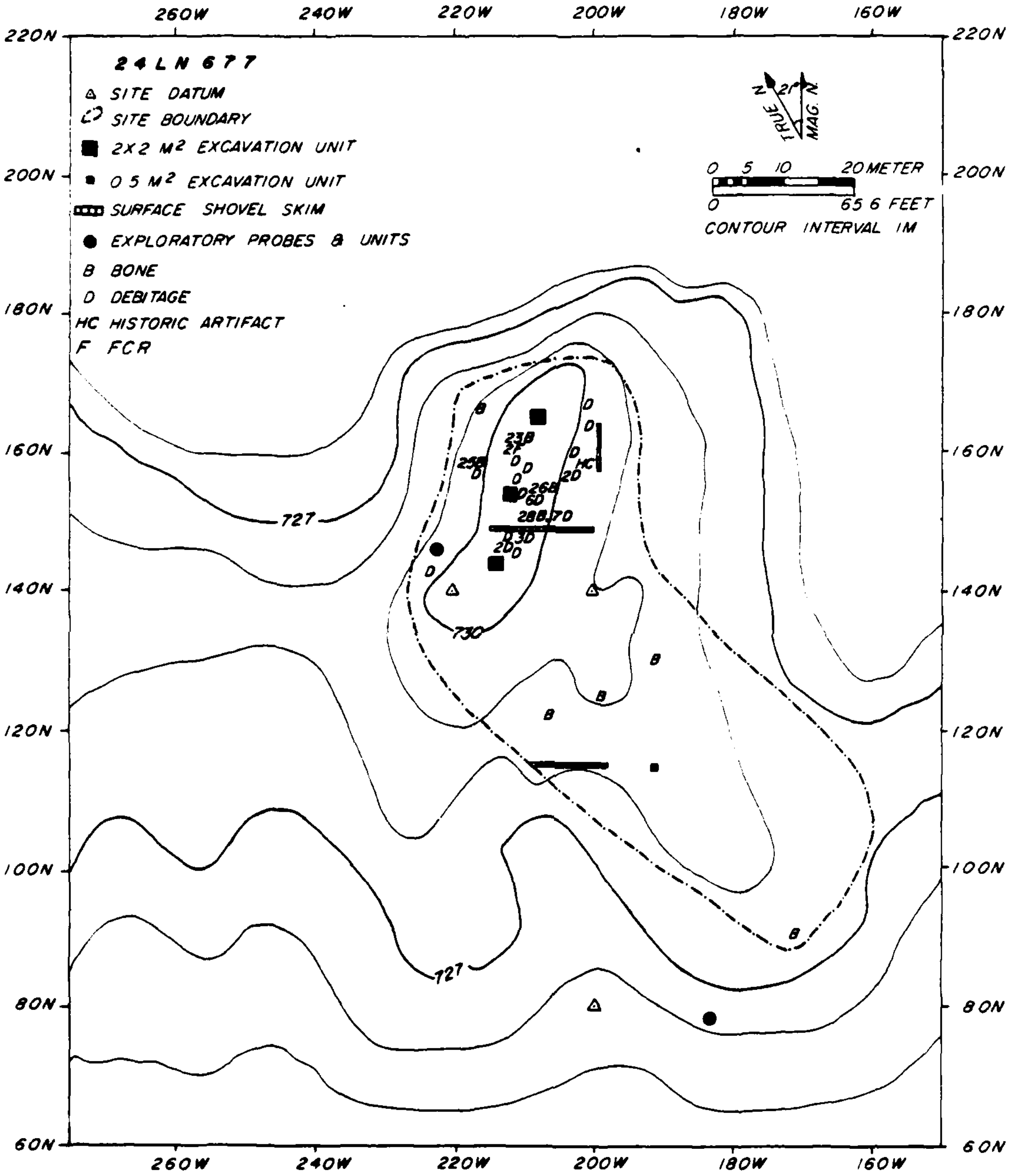


Figure 11-3. Map of 24LN677, a low diversity site.

Three 2 x 2 m units were excavated within the dense concentration area. One unit was located over the densest bone concentration, in anticipation of collecting a quantity of bone sufficient for C-14 dating. A second 2 x 2 m unit was excavated at the north end of the general bone scatter, and a third over the small FCR cluster at the north end of the site. Two of the 1 x 1 m units within each 2 x 2 were excavated to 10 cm below the last cultural material, then one of them was excavated to 30 cm below culture bearing sediments. The remaining two 1 x 1s in each 2 x 2 m unit were excavated to 10 cm below surface to collect the major portion of cultural material present.

Descriptive Results

Most of the subsurface material was from the 2 x 2 m test unit excavated over the dense concentration of burned bone. The unit excavated over the general bone scatter yielded only nine flakes, one FCR fragment and a few burned bone bits. The 2 x 2 m unit excavated over the FCR feature yielded only five FCR. Cultural material in both units was largely confined to the first 5-10 cm in LKDI sediments. The shovel skim lines produced material only in the units adjacent to the dense bone feature. The shovel skim line and the .5 x .5 m unit on the east arm of the site yielded only a few bone bits. A few pieces were recovered as deep as 26 cm below surface in the .5 x .5 m.

Several hundred bone fragments , numerous flakes and three pieces of FCR were recovered from the first 10 cm of the 2 x 2 m unit excavated over the dense bone feature. From 10 to 20 cm below surface, material density decreased, but about 100 bone fragments and 20 flakes were recovered. Cultural material declined sharpely below 20 cm, with 48 bone bits and two flakes recovered from 20-40 cm below surface, and a single small bone bit per level between 40 and 60 cm below surface. Most of the material below 40 cm, and perhaps below 20 cm below surface, is probably a result of bioturbation.

A variety of bone types was recovered from the excavated portion of the dense bone feature. Most (73.4%) were the small (less than 2 cm) rectangular bits of burned bone that are common at many sites in the area. However, several pieces of split or splintered long bones were present. Of the 812 pieces of bone from the feature only two were identifiable to the genus level, both were deer. The splintered long bone fragments were neither burned nor as weathered as the other bone and for those reasons were excluded from the sample subjected to C-14 analysis.

A large number of flakes was recovered from the bone concentration feature. The flakes were predominantly mudstone and a chert-like material that is a metamorphic mudstone. They range from large, primary decortication flakes to small pressure flakes. Most came from the upper 10 cm of the deposit. In addition, the feature also yielded several burned fragments of a brown, opaque, fossilerous chert biface. When these fragments were pieced together they formed the blade portion of a dart size projectile point.

A total of 133 flakes was recovered. In addition to the flakes and the projectile point fragment, 27 pieces of shatter, 3 thin edge modified flakes, a biface IV and 8 pieces of FCR were recovered from the surface and test units (Table 11-5).

Interpretation

Results of test excavation indicate that the principal activity area of site 24LN677 was approximately 400 m^2 in size and extended north and east from the excavated bone feature. The major portion of the surface cultural material was found within this area, and the only significant subsurface deposits came from within the general bone scatter. It is likely, then, that the bone feature was a major focal point of occupation at the site.

Considering the similarities in raw material types and kinds of flakes across the site, it is likely that 24LN677 represents a single event or at most a few encampments at the same locality by individuals carrying out similar activities. The burned bone sample yielded a date of 3,260±100 B.P. (Beta-4989, a C-13 adjusted age; without adjustment: 3,170±100 B.P.). The blade portion of the dart sized projectile point recovered from the bone feature could be a fragment of a number of the projectile point subclasses, but is most similar to the large wide notched and large, indented base classes in terms of morphological, technological, and metric attributes.

The season of occupation is uncertain, but the lack of nearby permanent water may be indicative of a winter or spring occupation, when water would have been available from nearby gullies or basins. The abundance of small bone bits suggests that the site functioned as a hunting and probably meat and bone processing camp.

Limited lithic tool manufacture or refurbishing also occurred at the site in the immediate vicinity of the food processing locale. This activity is inferred from the presence of a large number of flakes in and near the bone concentration areas, and by the presence of mudstone and chert shatter. The lack of cores indicate that primary reduction may have taken place elsewhere, but the number of larger flakes indicate that activity was not limited to resharpening.

Site 24LN707 (Laurel Grove)

Site 24LN707 is located in the Lower Canyon zone on the east side of the Kootenai River. It is on T8, at an elevation of 2,470 feet (753 m) amsl, and has a southern solar exposure. The nearest permanent source of water is Five Mile Creek, which lies about 15 m below and 50 m southwest of the site. There are no nearby intermittent water sources. Like 24LN704, this site is adjacent to and above the high water level of Lake Koocanusa (Figure 11-4). Douglas fir, pine, chokecherry, and various grasses cover the site.

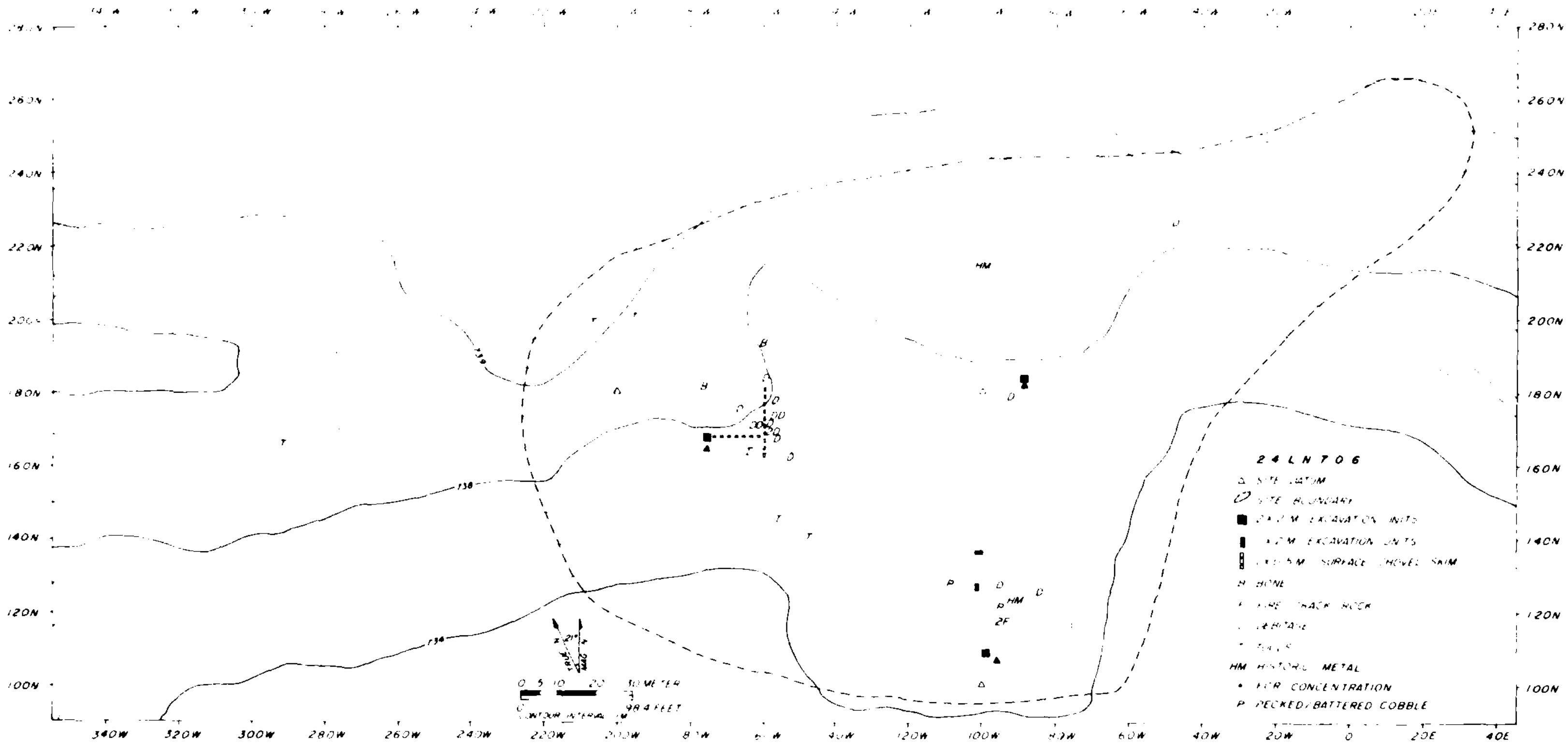


Figure 11-7. Map of 24LN706, a high diversity site in the Kootenai Flats area.

as vegetal processing tools, coupled with the presence of burned and unburned bone fragments, indicates that 24LN366 was the locus of hunting related activities. Heavy-duty tasks, as indicated by thick tools are not well represented. Assuming the artifact concentrations are not the result of modern activities, the site could be interpreted as a repeatedly occupied camp

Site 24LN706 (Laurel Grove)

This Kootenai Flats site is on the southern edge of a dune, at an elevation of 2,410 feet (735 m) to 2,450 feet (747 m) amsl. The solar exposure is to the south. Sophie Creek lies about 1 km to the southeast and is the nearest permanent water source. Numerous gullies cross the area and the nearest one is about 145 m southwest and 12 m below the site. It could have been a water source during the spring. Historically, various species of conifers covered the site area. Overall, the site is in fair condition. Portions of the site are in good condition, but in other areas erosion removed as much as 50 cm of sediment and in still other places there is that much postreservoir deposition. Not only reservoir waters, but also the winds (during drawdowns) act to erode the site. For example, when the site grid was laid out, stakes were driven to or below the surface and three days later most of the stakes were exposed fully, as a result of aeolian processes.

General Nature of Cultural Materials

Site 24LN706 is a thin scatter of lithics, fire-cracked rock, and bone (Figure 11-7). Lithics were most common in the western part of the site. Fire-cracked rock occurred in several concentrations, one at the southern end, one at the north, and another in the west portion. Each of these features was more or less dispersed.

Stratigraphy

The upper surface of the dune is comprised of moderately well sorted, fine sands (LKD deposits). Erosional processes have exposed PMI sediments in some locations and PMII in others. In other parts of the site, PM deposits are overlain by less than 10 cm of LKDI sediments. At some time in the past (prereservoir) portions of the dune were eroded to the point of exposing a primary deposit of Mazama ash. At the northern crest of the dune this tephra is well stratified and does not overlie a paleosol. This same tephra layer was also exposed 60 m south of the dune crest. Here, the dune surface dips gently to the south and the exposed tephra overlies a weakly developed soil. Observed cultural materials were limited to sediments above the tephra deposit.

(abalone) shell, similar to the one from Area C, was recovered from Area B. While these shell fragments could be attributed to the historic farmstead occupation, it is more likely that they are representative of an aboriginal occupation, especially considering that the edges of the unburned specimen are scored and grooved.

Interpretations

Site 24LN366 is one of the few sites that exhibit several dense concentrations of artifacts within a larger surface scatter. As suggested earlier, these denser concentrations or areas may represent different activities and/or different occupations, but considering the degree of disturbance at the site, the areas may well be the result of farmstead construction and maintenance activities. Considering this, the following statements must be viewed as speculative.

The single arrow size projectile point fragment suggests a Late Prehistoric occupation and the dart size fragment could indicate an earlier occupation. Abalone shell could be indicative of a Late Prehistoric occupation since such trade items are more common at later period sites in the region, but this too is a tenuous suggestion at best.

The site's setting in proximity to a permanent water supply provides little insight into seasonality of occupation. However, if most hunting took place during the winter and early spring months, occupation could well have taken place then, considering that deer size (i.e., medium) bone, much of it burned, is the most common faunal remain. The high density of fire-cracked rock, especially in Area B, also could be interpreted as an indication of wet season (i.e., winter-spring) occupation, with the FCR being used to buffer heat loss in wet sediments. Although a rock lining for a hearth would buffer heat loss at anytime, conservation of heat energy would be most useful during the cold, wet season when fuel consumption would be at a maximum. Alternatively, the FCR could be indicative of stone boiling, which may have been a common activity during the dry season. Viewed from that perspective, activities in Area B would be different from those in other areas, but they well could have occurred at the same time.

The fact that areas A and C had far less FCR and comparatively more flaked lithics, could be an indication that they were occupied during drier seasons or perhaps during any season when stone boiling was not a major activity. Area D appears to be the remains of a single, but scattered, hearth-related feature. It yielded little in the way of seasonality, temporal, or functional indicators.

As a whole 24LN366 is similar to most sites in Kootenai Flats, but it encompasses a larger area and yielded more flaked lithics. The paucity of cores, in conjunction with the presence of many small flakes, suggests that most tool manufacturing activities were related to the maintenance of existing tools or final manufacturing stages utilizing existing blanks. A lack of nonflaked lithics, traditionally referred to

Table 11-7. Inventory of Recovered Tools and Byproducts from Site 24LN366.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	154	44.77
Quartzite Flakes/Chips	120	34.88
Chert Flakes/Chips	31	9.01
Other, Small Flakes/Chips	-	-
Cobble Cores	1	0.29
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	1	0.29
Shatter	23	6.69
Biface III	2	0.58
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	10	2.91
Arrow Size Fragments	1	0.29
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	1	0.29
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	344	100.00

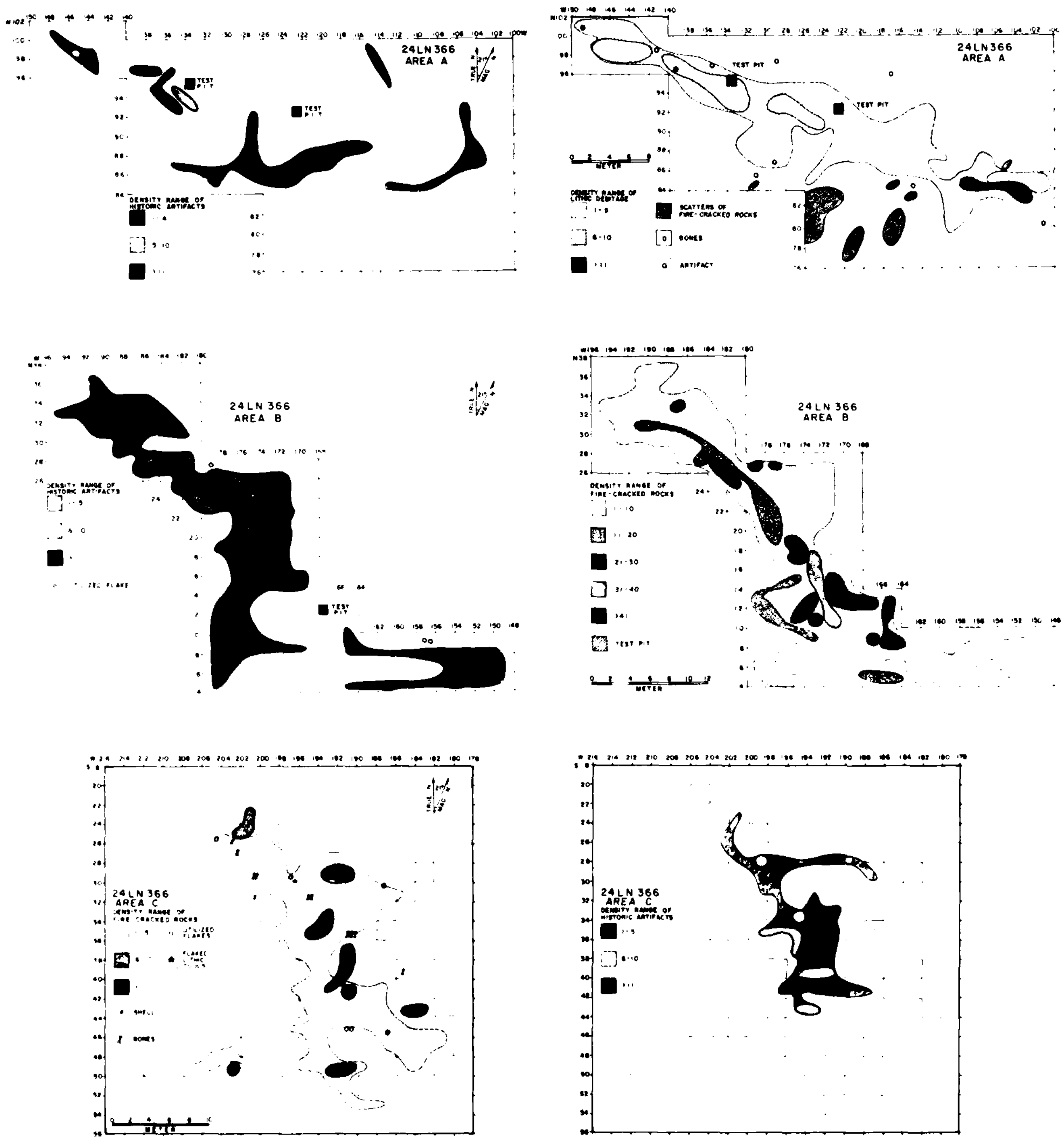


Figure 11-6. Cultural materials density and distribution maps for units A, B, and C from 24LN366.

materials were recovered from the disturbed (LKD) sediments. Test pits yielded a few flakes, and bone bits to a depth of 60 cm below surface.

Descriptive Results

The four areas that encompass most of the cultural materials are different in regard to the nature of cultural materials recovered from the surface (Figure 11-6). Area A exhibits comparatively little FCR, numerous flaked lithic tools, more flaked lithic debitage, and more bone fragments than the other areas. Test pits yielded cultural materials like those on the surface in the area. Most materials were confined to the disturbed sediments, but some continued to a depth of 60 cm below surface. Area B is characterized by the highest density of FCR and relatively low frequencies of flaked lithic debitage, and tools. The test pit in Area B revealed the presence of substantial quantities of burned bone fragments and numerous flakes to a depth of 60 cm below surface. Flaked lithic debitage and tools, as well as fire-cracked rock and bone, occurred in comparatively moderate frequencies in Area C. Cultural materials were not recovered from the test pit in Area C. Only a few pieces of FCR and a single flake were recovered from Area D. In the light of information derived from the other areas, test pits were not dug in Area D. Furthermore, the upper part of the prereservoir surface was eroded, and the density of materials was very low. The two test pits placed outside the overall surface scatter failed to yield definite cultural materials.

It is tempting to speculate that aboriginal behavioral significance can be assigned to the differences among the four areas. However, because the site is disturbed severely, the approach here is to consider the kinds of materials in the site as a whole as opposed to considering the materials recovered from each area.

A total of 344 lithic artifacts were recovered (Table 11-7). The vast majority were recovered from the surface and less than 20 items were from the test pits. Thin edge modified flakes were the most common tool types, but one arrow size projectile point fragment was recovered from Area C. A dart size projectile point fragment, along with flakes, FCR, and burned bone came from a test pit in Area B and two Biface IIIs were collected from the surface.

Faunal remains were relatively abundant (N=146) at the site, but most were too fragmentary for species identification. Three deer (*Odocoileus*), bones including one metatarsal with cutmarks, and an elk bone were the only identified archaeological mammalian fauna. Over 75 percent of the bone fragments considered to be indicative of aboriginal activities were less than 2 cm in maximum dimension and about 34 percent of those were burned. The *Bos/Bison* bone, two fish, and two very small mammal bones are nonarchaeological. An unburned piece of abalone shell was also recovered from the surface of Area C. This small rectangular fragment (ca. 1 x 1 cm) appears to have been scored and grooved along three edges (see description, Chapter 9). A smaller piece of burned shell, also abalone, was recovered from Area C. A third piece of burned

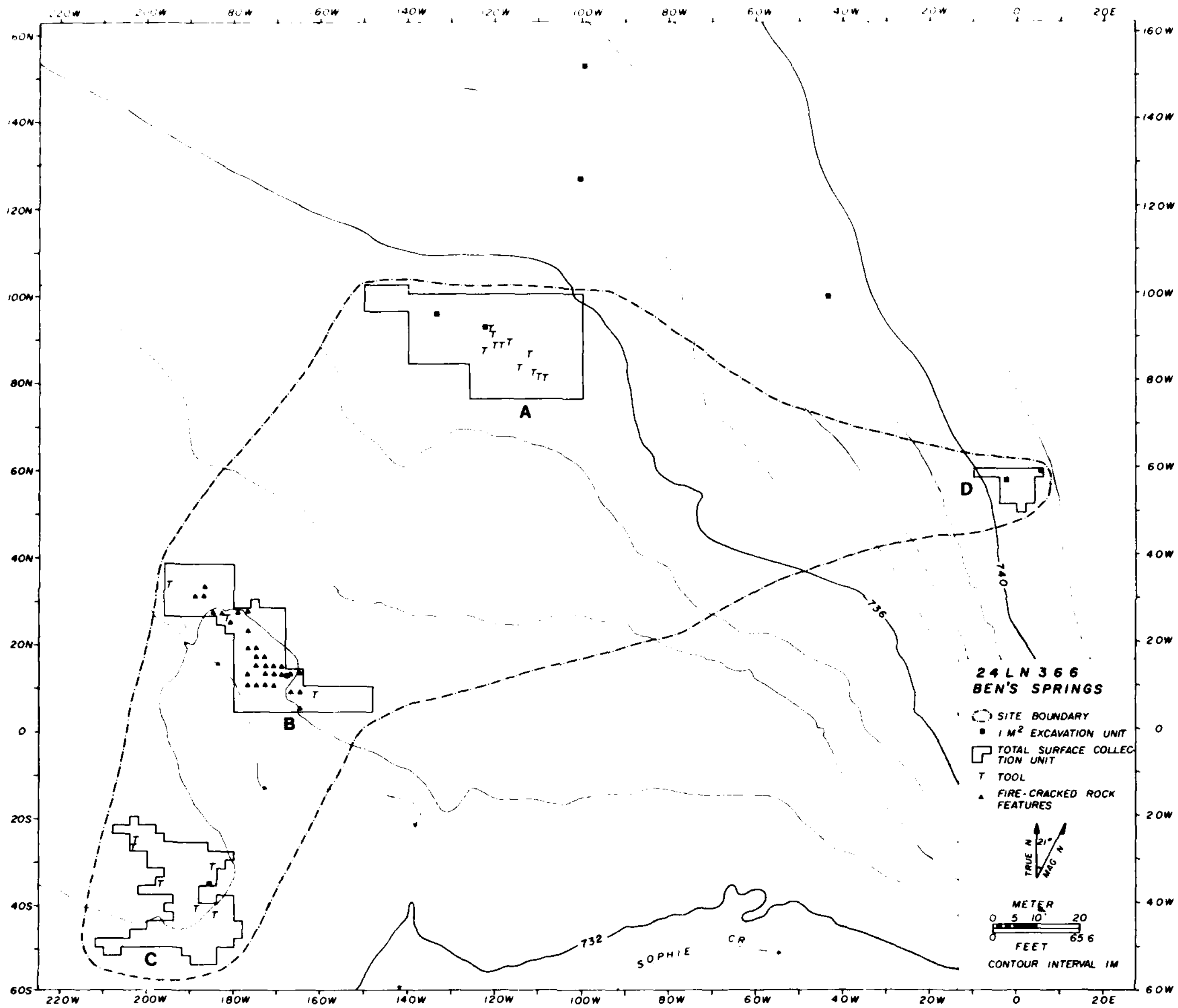


Figure 11-5. Map of 24LN366, a high diversity site, showing the location of the four surface collection units.

cultural materials are concentrated in four small areas (Figure 11-5). Area B contained large amounts of fire-cracked rock, including numerous FCR features, some of which contained burned bone bits as well as flaked lithic artifacts. Areas A and C contained comparatively less fire-cracked rock and more flaked lithics. Fire-cracked rock was the only kind of aboriginal cultural material in area D.

A great deal of modern cultural material was also found throughout this site. Examples include, glass and ceramic fragments, tin cans, wire drawn nails, electrical wires, plastic and metal pipes, and a variety of metal fragments, as well as pieces of barbed wire, bailing wire, and "hogwire." Examination of the USGS map and prereservoir aerial photographs confirms that a farm house and numerous outbuildings were located at 24LN366 prior to the construction Libby Dam.

Stratigraphy

Much of the surface has been disturbed, not only in conjunction with reservoir clearing, but also by a number of farm-related activities including construction of above-ground structures, as well as stock tanks. Judging from the few tree stumps at the site, there has been little postreservoir erosion. Excavation of seven, 1 x 1 m test pits, three of which were determined to be outside the site area, revealed that in most places LKD sediments including those disturbed by farm-related activities contained most of the cultural materials. Relatively undisturbed PMII deposits were encountered at depths ranging from 20 to 50 cm below the modern surface and continued to the bottom of the excavation units, 40-120 cm below surface. The PMII deposits were primarily wind-blown sands, but in test pits near the rim of Kootenai Flats and adjacent to small gullies, low percentages of gravels were observed. Presumably these gravels are from sediments that originated along the rim of Kootenai Flats and were redeposited in the site area as a result of fluvial and colluvial processes.

Testing Rationale and Methods

Field investigations at the Ben's Spring Site took place during the 1981 season. An intensive surface collection was made as a means to provide contrastive data for sites in the other zones. Each of four areas with comparatively dense concentrations of cultural material were subdivided into 2 x 2 m units as provenience controls, and all cultural materials were counted and/or collected. Fire-cracked rock was weighed before being discarded. Historic materials were tabulated but not collected. All flaked lithic artifacts were collected.

Test pits were dug within Areas A,B, and C as well as outside the general surface scatter of artifacts (Figure 11-5). These test pits were excavated primarily to determine the nature and extent of subsurface cultural materials and to a lesser degree, to determine site boundaries. The vast majority of agoriginal cultural material from these test pits was recovered from LKD sediments. All historic

group. This variation is apparent along several lines, but the more obvious differences are in the relative proportions of flaked and nonflaked lithic artifact types. The relative proportions of thin edge modified tools and some of those in the assemblage considered to represent heavy-duty activities (e.g., thick edge modified and nonflaked tools) tend to vary more than do the percentages of thin bifaces, thick bifaces, or cores. Among the 18 high diversity sites with more than 10 tools and cores, the relative frequency of thin edge modified tools ranges from 7.1 percent (24LN386) to 62.3 percent (24LN366). The relative frequency of nonflaked lithic tools varies from zero (24LN360) to 40.9 percent (24LN365), while that for thick edge modified tools ranges between zero (24LN394) to 20.4 percent (24LN1058). These and other differences, such as the number of FCR features, or the site's proximity to permanent water, are useful measures of differential land use systems.

The distribution of high diversity sites differs greatly from those in the low diversity group. Whereas only 25.5 percent (41 of 161) of the low diversity group are located in the Lower Canyon zone and 60.2 percent (97 of 161) of them are in the Tobacco Plains zone, the frequencies are reversed for high diversity sites. Of the 34 high diversity sites 52.9 percent (18) are in the Lower Canyon zone and only 26.5 percent (9) are found in the Tobacco Plains zone.

Before discussing the differences in the kinds of sites and implications regarding land use patterns, it is informative to describe several high diversity sites. Those described here are selected to illustrate the range of variation in the number and types of artifacts recovered from sites and the differences in settings. Site descriptions also provide the reader with information concerning the different ways in which sites were tested. Following the approach established for low diversity sites, the high diversity sites in the Tobacco Plains zone are discussed first, followed by those in the Upper Canyon, and the Lower Canyon sites are discussed last.

Site 24LN366

This Tobacco Plains zone site is located near the point where Sophie Creek enters Kootenai Flats. Site 24LN366 or the Ben's Spring Site is situated in a cove-like area on very low sand dunes or thin sheet sand, and it has a western solar exposure. Sophie Creek, a permanent stream, passes immediately south of the site. Elevation at the site is approximately 2,410 feet (ca. 735 m) amsl and most of the cultural materials are on a gently sloping surface. Judging from tree stumps in the vicinity, the site area was an open coniferous forest.

General Nature of Cultural Materials

Aboriginal and modern historic materials are scattered over a large area, approximately 36,000 m^2 in size, but most of the aboriginal

Table 11-6. Inventory of Recovered Tools and Byproducts from Site 24LN707.

Artifact Type (Morpho/Technological)	Quantity Absolute	Quantity Relative
Mudstone Flakes/Chips	68	37.36
Quartzite Flakes/Chips	5	2.75
Chert Flakes/Chips	6	3.30
Other, Small Flakes/Chips	94	51.65
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	6	3.30
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	3	1.65
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	182	100.00

Generally, the same materials appear throughout the deposits. These are fine and very fine mudstones of all colors. A few pieces of chert were recovered. Table 11-6 lists the flaked lithic artifacts recovered from the site. Nine identified-to-size class faunal remains were recovered. Most of them represent medium size mammals.

Interpretations

Site 24LN707 cannot be dated readily on the basis of artifactual evidence. Based wholly on the presence of artifacts in different age sediments there were occupations between 2,000 and 6,700 years ago, just prior to 6,700 years ago, and earlier still. However, as has been noted, there is evidence for extensive cryoturbation at 24LN707 and the stratigraphic position of artifacts probably belies their chronological position. Limited reuse of the same site may account for the widespread, but sparse distribution of cultural material. The number and kinds of artifacts recovered from the site indicate short-term occupations where a limited number of tasks were carried out. Some food items were probably prepared and/or consumed at the site, but available evidence indicates little else and there is little inherent in the site's location or in the nature of recovered artifacts to indicate season of occupation.

High Diversity Sites

Although there are only 34 (17.3% of the classified aboriginal sites) high diversity sites, well over 80 percent of all the artifacts were recovered from those sites. By definition, high diversity sites contain at least half of the 14 artifact types defined for classification purposes. High diversity sites tend to be those with high artifact frequencies, but there is enough divergence from that tendency to indicate sample size alone probably does not account for a significant number of the high diversity sites. Fifteen of the 34 high diversity sites have fewer than ten tools and cores, yet at a minimum, four different kinds of tools (including cores) must be represented when combined with flakes/shatter, fire-cracked rock, and bone, for the site to be classified as high diversity. Conversely, there are numerous sites with collections totalling hundreds (e.g., 24LN369, 24LN392, 24LN402, 24LN677, and 24LN1087) and even thousands (e.g., 24LN429 and 24LN704) of lithic artifacts, yet they are classified as low diversity sites. Furthermore, most of these sites were subjected to systematic surface and subsurface collecting techniques and are considered to have yielded samples that represent the sites' contents reasonably well. These kind of data provide strong indications that the distinction between high and low diversity sites is reasonable and probably significant.

Logically, high diversity sites are indicative of a greater range of activities than are low diversity sites, and it is not surprising that there is considerable intersite variation within the high diversity

Very little in the way of cultural materials was recorded on the surface of 24LN707. The upturned roots of trees held a few fire-cracked rocks and an occasional flake. Only one flake was found on the surface.

Stratigraphy

Although the site has never been inundated, its uppermost sediments are disturbed by logging and therefore termed LKDI. PMI sediments underlie LKDI and are as thick as 50 cm in some parts of the site; they are absent in others. The underlying AMII deposit varied from 10 to 30 cm in thickness and overlay the AMI unit. In some areas of the site AMI were not observed, but elsewhere they were at least 50 cm thick. Even though a number of artifacts were recovered from pre-Mazama sediments, the artifacts probably are younger than the sediments containing them. Cryoturbation was particularly active here and could well account for the presence of artifacts in old sediments (see profiles and descriptions in Chapter 7).

Testing Rationale and Methods

One excavation unit was placed in an apparently undisturbed area near the northermost tree tip-up. The others were placed along the western edge of the site in two other areas that appeared undisturbed. Two of the 1 x 1 m units were expanded in an effort to increase the artifact sample. A fourth test excavation unit was placed over an exposed concentration of fire-cracked rock in a tree-tip-up depression. This unit measured 2 x .5 m and like the others was excavated to 30 cm below the deepest cultural material found.

These test excavation units examined portions of the site where materials were known or seemed likely. Two lines of posthole exploratory excavation units, and a few scattered ones, were placed along the apparent eastern edge of the site, to ascertain site limits more accurately and to detect stratigraphic changes across the site.

Descriptive Results

As has been indicated, surface materials at site 24LN707 were rare. The uppermost excavated levels, in LKDI deposits, produced 6 flakes and 23 fire-cracked rocks. The lower PMI deposit yielded more flakes and fire-cracked rock as well as three edge modified flakes. Below the PMI, cultural material diminished although the AMI and AMII units contained flakes and shatter. Almost all of the deeply buried material came from the northernmost group of 1 x 1 m excavations units. A few flakes were recovered from the 2 x .5 m unit at the south end of the site.

Excavations, both in exploratory probes and 1 x 1 m units, revealed a much higher density of cultural material than would have been predicted from the surface. As a result of finding materials in the posthole probes, site boundaries were extended to encompass an area about 90 x 12 m in size.

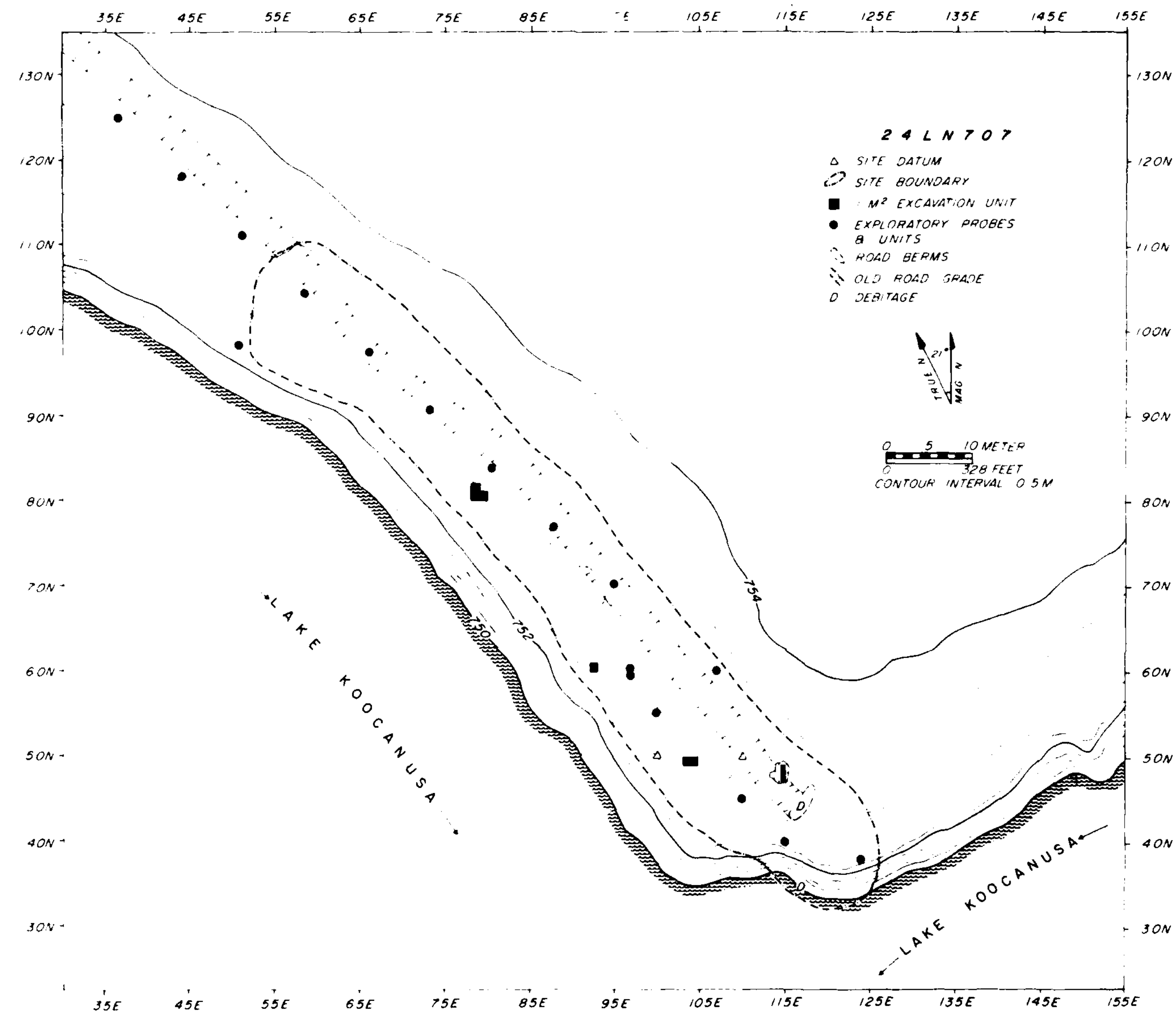


Figure 11-4. Map of 24LN707, a low diversity site.

Table 11-5. Inventory of Recovered Tools and Byproducts from Site 24LN677.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	64	39.02
Quartzite Flakes/Chips	11	6.71
Chert Flakes/Chips	56	34.15
Other, Small Flakes/Chips	2	1.22
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	26	15.85
Biface III	-	-
Biface IV	1	0.61
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	3	1.83
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	1	0.61
Early Prehistoric Projectile Points	-	-
Battered Stone	-	-
Ground Stone	-	-
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	164	100.00

Testing Rationale and Methods

Investigation began with flagging fire-cracked rock features, and all other cultural material. Flagged materials were plotted on the site map and all flaked lithics and identifiable bone were collected. Two shovel skim units were placed in the area with the highest artifact densities and where the paleosol was exposed. Another shovel skim unit, 1 x 2 m in size, was placed where the same paleosol was exposed in another part of the site.

Three of the fire-cracked rock features were in fairly good condition and a 2 x 2 m test excavation unit was placed over each one. The FCR were plotted and the feature was bisected. Half of each 2 x 2 was excavated to 30 cm below cultural materials; the other half was shovel skimmed. A fourth test excavation unit was placed in an area where the paleosol appeared to be buried and intact. This 1 x 2 m unit was located between two of the excavated fire-cracked rock features.

Descriptive Results

Artifacts were scattered over an area 24,400 m^2 in size. Five fire-cracked rock features, each made from several kinds of rock, were identified. The number of FCR in these features ranged from 5 to 16. FCR was recovered from below the surface in the PMII deposit at only one feature, and then only two isolated pieces of fire-cracked rock were encountered. The test excavation unit placed where the paleosol was expected failed to yield the paleosol or cultural materials.

Five arrow and dart size projectile points and fragments, two edge modified flakes, and four nonflaked lithic tools, as well as 35 pieces of flaked lithic debitage were recovered from the surface. Dark fine grain mudstone and quartzite were the most abundant lithic materials, but all five projectile points were made of chert. Only one piece of chert was recovered that was not utilized (Table 11-8).

Interpretations

The projectile points indicate that the site dates to the late or late Middle Prehistoric Period. It was probably a short-term campsite, reused several times, as evidenced by the range of projectile point styles and by the widespread distribution of FCR features. This site has the minimal range of artifact types to be classed as a high diversity. The low density of FCR also suggests limited activities. If it is a short-term occupation site, access to a local water source would not be essential. Because this site has the highest relative frequency of projectile points (i.e., of sites with representative collections), undoubtedly it is related to some kind of hunting activity. The fact that four of the five points have broken bases and consist primarily of the blade portions suggests that 24LN706 could be a kill site. If animals were killed nearby and meat and/or hides were the desired products, then an assemblage like that recovered would be expected.

Table 11-8. Inventory of Recovered Tools and Byproducts from Site 24LN706.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	14	30.42
Quartzite Flakes/Chips	12	26.09
Chert Flakes/Chips	2	4.35
Other, Small Flakes/Chips	-	-
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	7	15.22
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	-	-
Edge Modified Flake/Chip	2	4.35
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	2	4.35
Late Middle Prehistoric Projectile Points	1	2.17
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	2	4.35
Early Prehistoric Projectile Points	-	-
Battered Stone	2	4.35
Ground Stone	2	4.35
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	46	100.00

There would be little evidence for lithic reduction other than reconditioning flakes and a few hammerstones or anvil stones might might have been used to dismember the prey. Projectile points would have been used to dispatch the prey and the edge modified flakes to remove meat from bones. Clearly there are problems with interpretations and they stretch the data a considerable distance. Nonetheless, one would expect to find locations that functioned as kill sites (even those where removal of meat from bones was the only butchering) in the project area.

Site 24LN417 (Sheila J. Bobalik)

This site is located on the east side of the reservoir, near the mouth of the Tobacco River. It lies at an average elevation of 2,430 feet (741 m) amsl. This Tobacco Plains zone site has a northern exposure. Cultural materials are scattered across the center of a dune and the northern margin of T7. The dune is immediately west of the terrace. Site 24LN417 is one of several sites in the New Rexford Site Cluster, located on the south side of the Tobacco River (Figure 11-8).

The Tobacco River, which provides a permanent water source, is approximately 270 m northwest and 35 m below the site. Based on the presence of burned tree stumps, the area was a coniferous parkland. The site is disturbed by logging and pothunting activities and repeated fluctuations in the reservoir level. Heavy equipment tire tracks are visible especially on the terrace portion of 24LN417. Erosion has removed at least 10 cm of the prereservoir sediments particularly from the terrace portion of the site. However, some areas of the site are covered by 3-30 cm of postreservoir sediments. Deposition is more extensive along the western margin of the dune. A jeep trail runs along the southern edge of the site. Pothunters have disturbed many of the surface features.

General Nature of Cultural Materials

Cultural materials were scattered across a 220 by 200 m area (Figure 11-8). The inventory included flakes, biface fragments, projectile points, modified flakes, burned and unburned bones, isolated FCR and unmodified cobbles (possibly furniture rocks). Twenty FCR features also were observed. Most of the surficial bone and flaked lithic artifacts were concentrated on the dune. In contrast, FCR features were more frequent on the terrace portion of the site. Thirteen of the 20 FCR features were observed on the terrace. Six of these were concentrated within a 10 m diameter area at the northeastern projection of the terrace. Other artifact types were observed infrequently on the surface of the terrace portion of the site. Scattered FCR densities ranged from low to medium on the dune, and from very low to low on the terrace part of the site. Although quartzite was the most frequently observed FCR material, other materials were present.

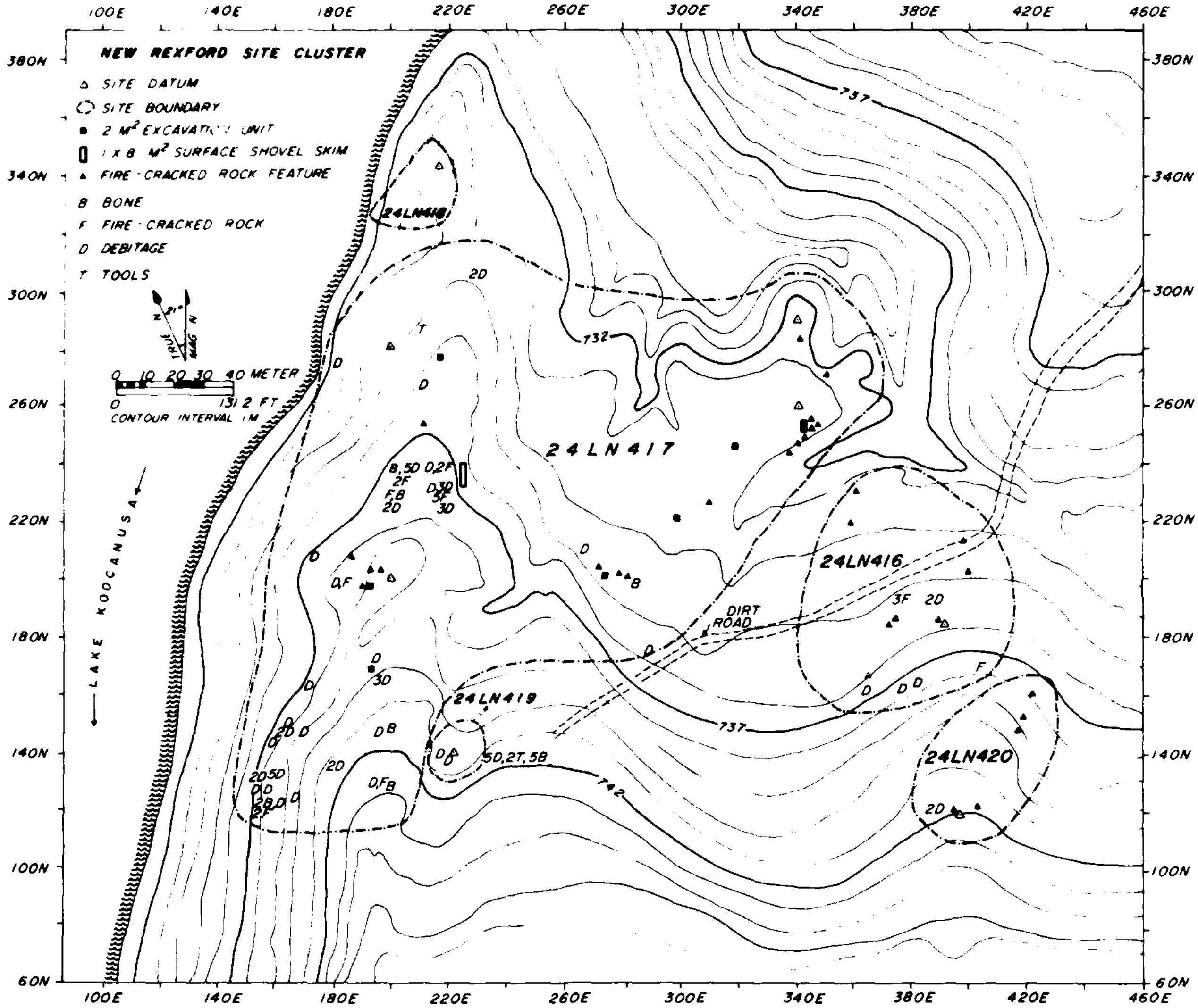


Figure 11-8. Map of New Rexford site cluster near the mouth of the Tobacco River showing the location of 24LN417, a high diversity site.

Stratigraphy

Over much of the site the upper 3-30 cm of sediments represent postresevoir deposits (LKDII) of very fine sands. These tend to be underlain by LKDI sediments that include burned wood and pine needles. LKDI sediments varied from 5 to 40 cm in thickness. On the dune (Figure 7-10), 3-150 cm of the underlying PMII deposits were examined. AMII sediments were below the PMII deposit. On the terrace, PMI deposits were observed below the LKDII and LKDI sediments. The PMI sediments varied between 10 and 30 cm in thickness and overlay 10-50 cm of the AMII and AMI sediments. The terrace deposits represent reworked sheet sands. The vast majority of cultural material was recovered from the upper 30 cm of the site primarily from LKDII or LKDI deposits. A few artifacts were recovered from as deep as 60 cm below the surface.

Testing Rationale and Methods

During a systematic survey of the site area, all cultural remains were marked with color-coded wire flags. The density of isolated FCR was noted for 20 x 20 m areas. All flaked and nonflaked lithics were collected. In eight cases, a 1.15 cm radius dog-leash unit was used to collect surface artifacts found in close proximity. Provenience, number of items, material type, associated artifacts, and diameter were recorded for the FCR features, five of were partially excavated.

Subsurface investigations included the excavation of six 2 x 2 m units, four contiguous 1 x 1 m units and an 8 x 1 m shovel skim unit. Three of the 2 x 2 m units and the four contiguous 1 x 1 m units were used to examine five of the FCR features more extensively. One of the 2 x 2 m units was placed over a fairly dense FCR concentration on the western margin of the dune. Two of the 2 x 2 m units were placed over partially buried FCR features on the dune and on the terrace. Probing with a wire flag indicated the presence of several FCR below those on the surface. It was thought these could represent more intact features. The four contiguous 1 x 1 m units sampled two of the large, dense FCR features located on the northeastern projection of the terrace. The three remaining 2 x 2 m units were placed between FCR feature areas on the dune and on the terrace.

At least one 1 x 1 m quad within each 2 x 2 m unit was excavated into the sterile deposits and a posthole was dug through the unit floor before terminating excavation. As a result, depths of the 2 x 2 m and 1 x 1 m units ranged between 10 and 180 cm.

The 8 x 1 m shovel skim unit was placed so that it intersected a slight concentration of flakes observed near the eastern margin of the dune. Each segment (i.e., 1 x 1 unit) was dug through the LKD sediments and 3 cm into the undisturbed PMII deposit. Depth of shovel skim units varied between 23 to 33 cm. Subsequently, one of these 1 x 1 m segments was excavated into the underlying deposits. It was terminated at 70 cm below surface,after three sterile levels.

Descriptive Results

As noted, 20 FCR features were observed. The 15 that only received surface documentation consisted of 4 to 47 FCR within areas as large as .5 x 3.6 m. One of the smallest features also contained a single burned bone fragment. Two of the larger features from the northeastern concentration of features yielded a chert flake and a piece of chert shatter. No other artifacts were observed in association within features. Quartzite was the only FCR material noted in eight features. Quartzite and other raw materials were observed in the seven other features.

On the surface, the largest excavated FCR feature on the dune consisted of approximately 75 quartzite FCR within a 2 m^2 area. A few burned bone fragments were also observed. Subsurface materials consisted of only a few flakes and pieces of FCR. These artifacts were generally restricted to the upper 20 cm of the deposit, although a few FCR were recovered as deep as 50 cm. The majority of the flakes came from the waterscreen samples.

The partially buried FCR feature at the northern end of the dune consisted of nine quartzite FCR scattered over an area 1.5 m in diameter. A similar quantity of FCR, a few flakes and pieces of shatter, and a small cluster of bone fragments were observed between 0 and 10 cm below surface. The bone concentration consisted of several burned and unburned bone fragments within a 50 cm area. This concentration was approximately 20 cm south of most of the FCR. Two flakes and a small unmodified cobble were recovered between 10 and 20 cm below surface.

The partially buried FCR feature on the terrace consisted of five surface FCR within an area 45 cm diameter. However, nearly 50 FCR and numerous burned bones were observed just below the surface (level 1, 0-10 cm). Fewer than five FCR were recovered from levels 2 and 3.

As mentioned, two of the large, dense FCR features on the northeastern terrace projection were excavated. The northern feature consisted of 47 surface FCR clustered within a 2 m^2 area. Although most of the FCR were quartzite, fine grain mudstone FCR also were present. Over 400 FCR, a few flakes and pieces of shatter and a biface were recovered from the disturbed upper 30 cm of the deposits. These materials came from two 1 x 1 m units. Cultural materials were not observed below 40 cm. The other excavated FCR feature was approximately 50 cm south of the previously described feature. On the surface, nearly 50 pieces of FCR were observed within an area 1.5 m in diameter. Quartzite was the most common FCR material, although fine grain mudstone was present. Nearly 950 pieces of FCR, a few flakes, two small side-notched projectile points, and a biface were collected from the two 1 x 1 m units over the feature. Cultural materials were recovered primarily from the disturbed upper 30 cm.

Only two pieces of FCR and one flake were recovered from the two 2 x 2 m units placed between FCR features on the terrace. These artifacts

were confined to level 1 (0-10 cm). The 2 x 2 m unit located away from the dune FCR features yielded four flakes and two FCR. These were primarily from the upper 30 cm.

A small amount of cultural material was collected from each segment of the 8 x 1 m shovel skim unit. Included were nearly 15 flakes/shatter, 20 FCR, and 3 bone fragments. Only one item was recovered below 25 cm in the undisturbed sediments.

The unmodified cobbles (furniture rock?) scattered over the surface ranged between 10 and 30 cm in size. One was quartzite whereas two were a fine grain mudstone material. Material type was not determined for two other cobbles.

A somewhat limited variety and quantity of cultural remains were observed at this high diversity site. Flakes and shatter were the predominant artifacts (Table 11-9). The vast majority of the materials came from disturbed LKD deposits. A total of 70 faunal remains was recovered. Two unidentified shell fragments and a fish bone were judged to be intrusive. The vast majority (82.9%) of the faunal remains were burned bone fragments less than 2 cm in size. Most of these appeared to be from medium size mammals.

Nearly 60 percent of the lithic artifacts from 24LN417 are fine grain mudstone, primarily black in color. A variety of quartzites are the next most frequent material type. Cherts are minimally represented, although the bifaces and the projectile points are made of chert. All of the modified flakes are mudstone.

Interpretation

Based on the projectile point styles and the stratigraphic record, it appears the entire area was utilized during Late Prehistoric times. The cultural inventory from 24LN417 suggests repeated, short-term occupations. Hunting and lithic reduction are indicated activities. However, the flaked lithic artifacts suggest only the later stages of the reduction sequence was emphasized. Some resource processing is indicated by the edge modified flakes, burned and unburned bones, and the numerous FCR features. The features may represent residue from hearths and/or stone boiling activities. The northern exposure does not suggest a winter occupation. The Tobacco River could have been a water source during summer or fall occupations.

Site 24LN656 (Laurel Grove)

Site 24LN656 is located on the west side of the river in the Upper Canyon zone. Parsnip Creek, a permanent tributary is about 3 km to the south. The site is on an alluvial fan graded to the T5 terrace, at an elevation of 2,330-2,365 feet (710-721 m) amsl. It is situated on the eastern edge of the central portion of the landform. The site has an eastern solar exposure. Characteristically, high diversity sites in the Upper Canyon zone have good to moderate solar exposures.

Table 11-9. Inventory of Recovered Tools and Byproducts from Site 24LN417.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	121	51.49
Quartzite Flakes/Chips	25	10.64
Chert Flakes/Chips	14	5.90
Other, Small Flakes/Chips	40	17.02
Cobble Cores	-	-
Decorticated Cores	-	-
Bipolar Cores	-	-
Biface I and II	-	-
Shatter	27	11.49
Biface III	-	-
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	1	0.43
Uniface	-	-
Edge Modified Flake/Chip	1	0.43
Arrow Size Fragments	1	0.43
Late Prehistoric Projectile Points	3	1.28
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	-
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	-	-
Battered Stone	1	0.43
Ground Stone	1	0.43
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	235	100.00

The nearest permanent water source is the Kootenai River, flowing some 145 m to the east of and 45 m below the site. Intermittently, water is available from the many alluvial fan streams. The nearest is about 30 m south of the site. It flows during the late winter and spring. The many stumps attest to the conifers that once covered the landform.

Like all sites in the drawdown zone, 24LN656 was damaged to some extent by clearing activities associated with reservoir impoundment. The site also was damaged during the construction of old State Highway 37. In addition, 24LN656 has long been subjected to erosion due to the numerous rills that traverse the site from west to east. Despite this wide range of disturbance processes, large portions of the site remain in relatively good condition, with only the upper most sediments being removed by reservoir waters.

General Nature of Cultural Materials

Flaked and nonflaked lithic tools and byproducts, bone and FCR are scattered over a large area (35,200 m^2). The majority of cultural material is fire-cracked rock. There are several concentrations of flaked lithics; these tend to be on the projections between gullies. FCR is scattered throughout the site, but there are several dozen FCR features, many of which are very discrete. FCR features are found the length and breadth of the site (Figure 11-9).

Stratigraphy

The landform on which the site is located developed by vertical accretion of alluvial fan deposits over a basal unit of Kootenai River gravels. The depositional process remains active. Cultural remains are confined to the upper portion of the fan deposits, which texturally are silt loam with a variable but small gravel content. LKDI sediments are restricted to the upper 10 cm; the underlying PMI sediments are 40-80 cm thick which are in turn underlain by about 30 cm of AMII sediments (Figure 7-10).

Under some portions of the site a moderately expressed paleosol B horizon was preserved within the lower fan (AMII) deposits. Excavation units were dug there in anticipation of detecting cultural remains; none were discovered.

Testing Rationale and Methods

All flaked and nonflaked lithic artifacts, with the exception of isolated pieces of FCR, were flagged and plotted on the site map as a means of documenting the distribution of artifacts. FCR features were described, flagged, and plotted on the site map. This effort clearly illustrated that most of the material occurred on the intergully projections.

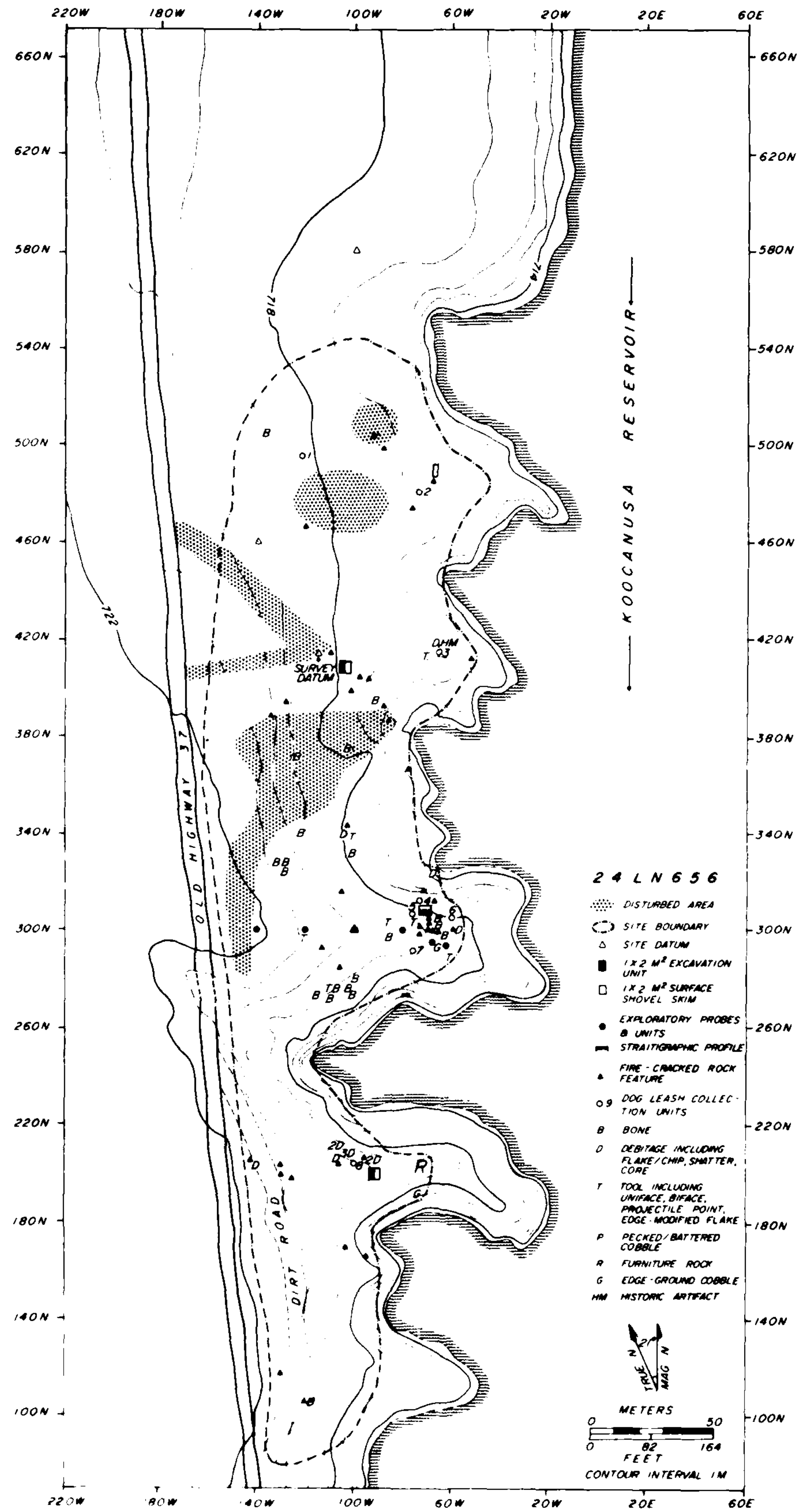


Figure 11-9. Map of 24LN656, a high diversity site in the Upper Canyon Zone.

Three discrete FCR concentrations, each on a separate promontory or projection, were selected for excavation. A 2 x 2 m excavation unit was placed over each feature and all exposed FCR were plotted. One half of the unit was excavated so that its profile would show the form of any staining or pit stratigraphy associated with the feature. Excavation continued through the buried paleosol. When the first half was completed, the other half was shovel skimmed.

Six other FCR features were selected for surface treatment. These too were in relatively good condition and were distributed along the length of the site. Some were chosen because they contained materials other than fire-cracked rock; others were chosen because they contained only FCR, at least according to initial inspection. In each case a dog-leash surface collection unit was centered over the FCR feature. A circle 2.25 m in radius was used over three large features and each was collected in quarters. Three smaller FCR features were covered by circular units with 1.15 m radii. The fire-cracked rock within each collection unit was counted and the sizes and material type of each piece were recorded before the specimens were weighed and discarded. All other cultural materials within the units were collected. Two features in particularly good condition were shovel skimmed because they were covered partially by postreservoir sediments that obscured their contents.

In order to gather information about those parts of the site without FCR features, six other dog-leash collection units were set up in areas away from FCR features. Several of these collection units were placed in areas of relatively higher densities of flaked lithics. As part of the standard operating procedures all tools observed at the site were collected and plotted on maps as were some flake types and raw materials not well represented in the collection units.

A number of posthole exploratory probes were dug along an east-west line in the central portion of the site to gather information concerning subsurface cultural material and to better understand the nature of the site sediments. The holes were at 20 m intervals and went to the depth of 1 m. Two more such probes were dug on the central promontory where a large, stemmed, concave base projectile point and an edge-ground cobble were found. The purpose of these two probes was to determine the presence of intact sediments and associated artifacts that could indicate an earlier occupation. Finally, a 1 x 1 m excavation unit was dug on the edge of the central projection, where the lower most paleosol was visible. The purposes were to provide a stratigraphic profile of the sediments and to examine sediments that could have been the source for the Early Period projectile point and edge-ground cobble.

Descriptive Results

A total of 51 fire-cracked rock features was recorded on the surface of site 24LN656. These concentrations of FCR ranged from 0.3 m^2 to over 2 m^2. Each included at least five pieces of rock; those investigated by excavation had, in the various cases, 228, 171, and 170

pieces of FCR on the surface. The underlying PMI deposits also produced FCR, but in much smaller quantities (9, 15, and 22, respectively from the first level below the LKDI). Approximately 90 percent of the fire-cracked rock identified at the site was quartzite. In part, this may be due to the fact that fire-cracked quartzite was more easily distinguished from the natural rock than were other materials. However, similar relative frequencies held for the features examined in detail.

Excavation of the features was intended to determine whether the surface manifestations were indicative of subsurface materials. Neither oxidized sediments nor pit stratigraphy were found in association with any of the FCR concentrations. It is possible that the fire-cracked rock features represent neither hearths placed in pits nor eroded hearths. Rather some of the features may be piles of boiling stones and others may be the remains of relatively intact hearths constructed on the surface. Twenty of the FCR features included many burned bone fragments and/or occasional flaked lithics. A biface fragment, possibly from a projectile point, and an arrow size point fragment were found in two different features.

A total of 335 lithic items was recovered (Table 11-10). The majority of flaked lithic artifacts were recovered from LKDI deposits. Fifteen of these were flaked tools and three were cores. The underlying PMI sediments contained about 24 percentof the flaked lithics recovered from 24LN656. None of these were classified as tool. The raw material type most commonly used for tools was dark fine grain mudstone, but quartzites and cherts are common. Mudstone was more abundant at the southern end of the site. All of the battered and ground stone tools were recovered from the surface.

A total of 331 faunal remains was collected, including 13 identified deer bones from at least two individuals. All of the deer bones were surface finds, but several exhibit cut marks. Numerous bone splinters and long bones without articulating ends were also recovered. The majority (90.6%) of the bone consisted of small, burned fragments.

There were a few distributional differences across the site. With the exception of one cluster of quartzite flakes on the north-central promontory, most of the flaked lithics come from the southern half of the site, and especially from the south-central promontory. This promontory also had the greatest density of fire-cracked rock features. The southern most promontory, which had numerous fire-cracked rock features, had fewer flakes, but these were more often of dark fine grain mudstone.

Interpretation

Site 24LN656 has more recorded FCR features than any other site in the study area. It also has obvious intrasite variability. The site's setting, adjacent to a permanent water source and its predominantly eastern solar exposure, suggest it may have been occupied during the the warm, dry season. Furthermore, under present climatic conditions runoff

Table 11-10. Inventory of Recovered Tools and Byproducts from Site 24LN656.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	56	16.70
Quartzite Flakes/Chips	108	32.20
Chert Flakes/Chips	3	0.90
Other, Small Flakes/Chips	-	-
Cobble Cores	1	0.30
Decorticated Cores	1	0.30
Bipolar Cores	-	-
Biface I and II	3	0.90
Shatter	144	43.00
Biface III	2	0.60
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	1	0.30
Uniface	-	-
Edge Modified Flake/Chip	8	2.40
Arrow Size Fragments	1	0.30
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	-	-
Early Middle Prehistoric Projectile Points	-	0.30
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	1	-
Battered Stone	3	0.90
Ground Stone	2	0.60
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	1	0.30
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	335	100.00

water traverses major portions of the site during the cool and wet late winter and early spring seasons.

A variety of activities are represented at the site. Fishing is suggested by proximity to the Kootenai River and by the presence of one notched pebble or net weight. The bone with cut marks and missing articular ends is suggestive of butchering activities, while the bone splinters could indicate marrow extraction or bone grease processing. Burned bone bits indicate the use of bone as fuel, although not necessarily in an intentional fashion. Finally, the presence of two facially ground stone objects (i.e., manos) may be indicative of plant processing.

The different concentrations of flaked lithic material types suggests the site was occupied several times and perhaps for different purposes. Occupation could have been by rather large groups, judging from the proximity of nonoverlapping FCR features. It also is suggested that the bulk of occupation occurred during the Late Prehistoric or late Middle periods. This statement is supported by the abundance of cultural material on or near the surface in an active depositional environment. The presence of the arrow size projectile point fragment and an undetermined size projectile point fragment lends some support to the suggested late ocupation. The large, stemmed, concave base projectile point and perhaps the edge-ground cobble might be used to argue for an Early Period occupation. While the site may have been occupied during early time periods, cultural materials were not recovered from undisturbed paleosols considered to be several thousand years old. Furthermore, edge-ground cobbles often occur with more recent cultural materials in the study area. It is quite likely that the early style projectile point is out of context, either as a result of natural processes or transport to the site by people.

Site 24LN388 (Sheila J. Bobalik)

This Upper Canyon zone, high diversity site is located on the southern edge of a large relatively flat landform, graded to T8. Elevation is 2,450 feet (747 m) amsl. This site is on the east side of the reservoir and has a southern exposure. The Kootenai River is the nearest permanent water source, 540 m south of and 80 m below the site. A gully is located approximately 10 m vertical and 50 m horizontal from 24LN388 and presumably would have been fed by early spring snow melt. However, it was dry in early April of 1982. Burned tree stumps are scattered across the landform, demonstrating that the area supported a coniferous forest.

Presently the northern portion of the landform (above Lake Koocanusa) is covered by an open coniferous forest. Heavy equipment tire tracks and bulldozer cuts are numerous in the 30 m wide area of young conifers (secondary growth after logging) between the drawdown zone and the forested slope above. A series of denuded, modern reservoir strand lines are present along the slope at the southwest edge of the site. Up to 2 m of prereservoir sediments have been removed from

understanding of the artifact distributions. Given the large quantity of surface materials and the extensive collections made in 1981, only a few surface artifacts were provenienced and collected in 1982. These items generally included tools and unusual material types. Also in 1982, the density of isolated FCR was estimated for 20 x 20 m areas.

Subsurface strategies included the excavation of nine .5 x .5 m units (i.e., exploratory excavation units), five 1 x 1 m units, two 2 x 2 m units and 11 exploratory probes (20 cm diameter posthole). All units were dug in 10 cm increments. Following the standard practice, constant volume waterscreen samples were collected from each level, except for the exploratory probes. Prior to the placement of each excavation unit, a small trowel hole was dug near the proposed unit location to assess the nature of the deposits. It was anticipated that this procedure would facilitate avoidance of major disturbances such as slash piles, massive eroded or pothunted areas, and extensive tree burns.

The nine .5 x .5 m units were excavated first. These units were spaced roughly north-south along the terrace projection in order to sample across the site. Excavation depths varied from 80 to 100 cm. Because a limited quantity of artifacts was recovered consistently from the bottom of the .5 x .5 m units in the AMI deposits, larger units were excavated. Five 1 x 1 m units were opened. Three of these were placed adjacent to .5 x .5 m units that had yielded deep cultural remains. Two of the 1 x 1 m units were located near the southern end of the landform because it appeared this area represented the major locus of prehistoric use. These units were generally terminated after three sterile levels; depths varied between 90 to 150 cm.

Two 2 x 2 m units were placed in the southern end of the site. These units were excavated in an attempt to increase the sample of the artifacts from the AMI unit. This area of the site had yielded cultural remains more consistently from the lower stratigraphic units. Threesterile levels were dug in at least one of the 1 x 1 m quads for each 2 x 2 m unit. Therefore, depths ranged between 80 cm to 150 cm.

In an attempt to clarify the suspected site boundaries and to determine the extent of postreservoir disturbance, a series of systematically placed exploratory probes were excavated. The 11 units were located at 10 m intervals along three east-west grid lines. These 20 cm diameter postholes were dug and screened in approximately 20 cm levels to a depth of 100 cm below the surface.

Three stratigraphic profiles were made to facilitate description of the site's sedimentary units (see Figure 7-10). These were done on three progressively lower modern reservoir strand lines at the south end of the landform. Because cultural material was observed while initially cleaning the highest profile, all wall shavings and slump removed from this profile area were screened.

Table 11-12. Inventory of Recovered Tools and Byproducts from Site 24LN1054.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	10,829	57.43
Quartzite Flakes/Chips	4,573	25.21
Chert Flakes/Chips	1,555	8.25
Other, Small Flakes/Chips	548	2.91
Cobble Cores	57	0.30
Decorticated Cores	14	0.07
Bipolar Cores	3	0.02
Biface I and II	50	0.27
Shatter	730	3.87
Biface III	89	0.47
Biface IV	15	0.08
Miscellaneous Hafted/Indeterminate Biface	5	0.03
Uniface	8	0.04
Edge Modified Flake/Chip	268	1.42
Arrow Size Fragments	2	0.01
Late Prehistoric Projectile Points	9	0.05
Late Middle Prehistoric Projectile Points	11	0.06
Early Middle Prehistoric Projectile Points	20	0.11
Dart Size Fragments	15	0.08
Early Prehistoric Projectile Points	3	0.02
Battered Stone	40	0.21
Ground Stone	6	0.03
Grooved/Incised Stone	4	0.02
Pecked Stone	1	0.01
Notched Pebbles	1	0.01
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	18,856	100.00

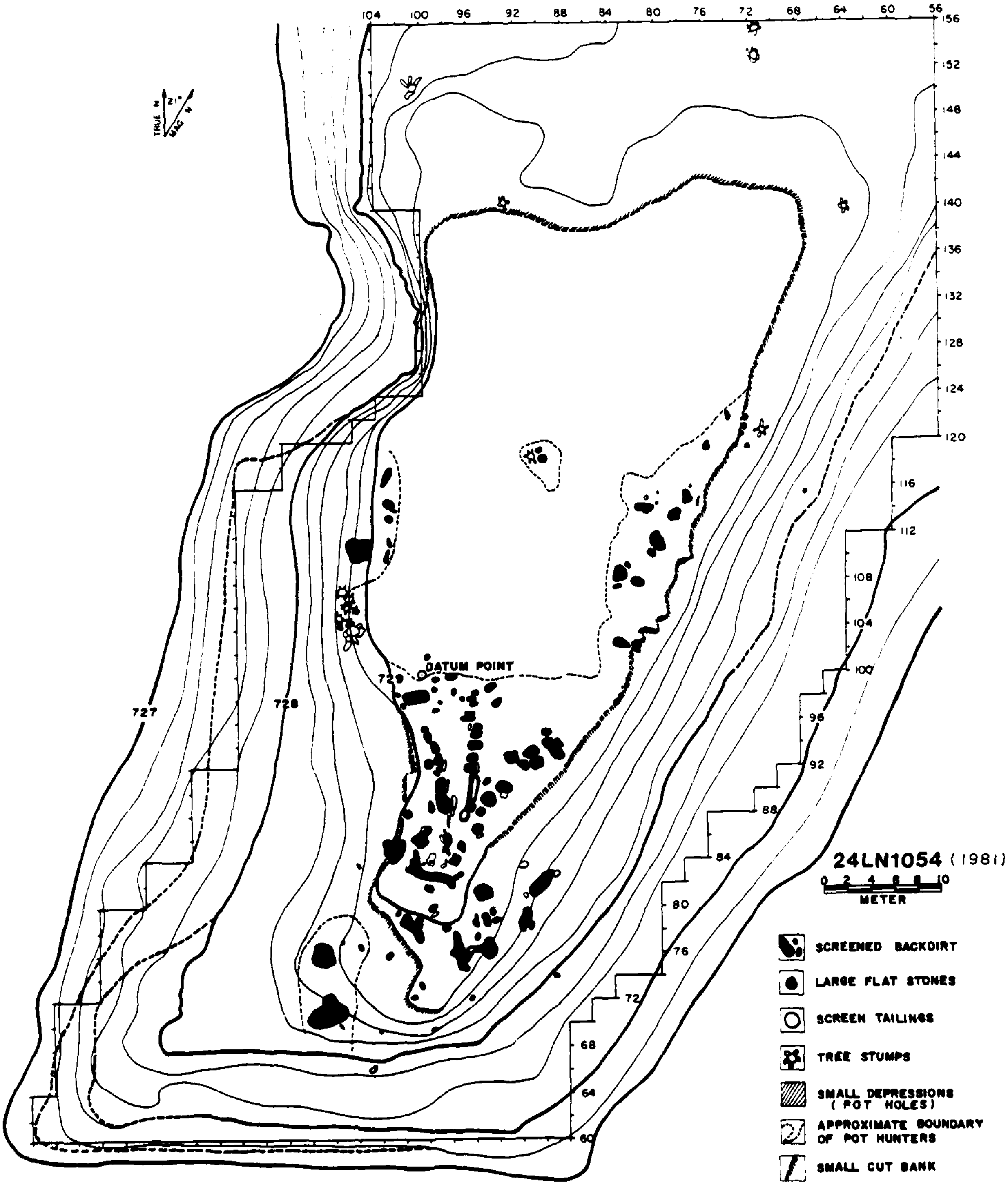


Figure 11-13. Map of 24LN1054 in 1981 showing the location of pothunter disturbance.

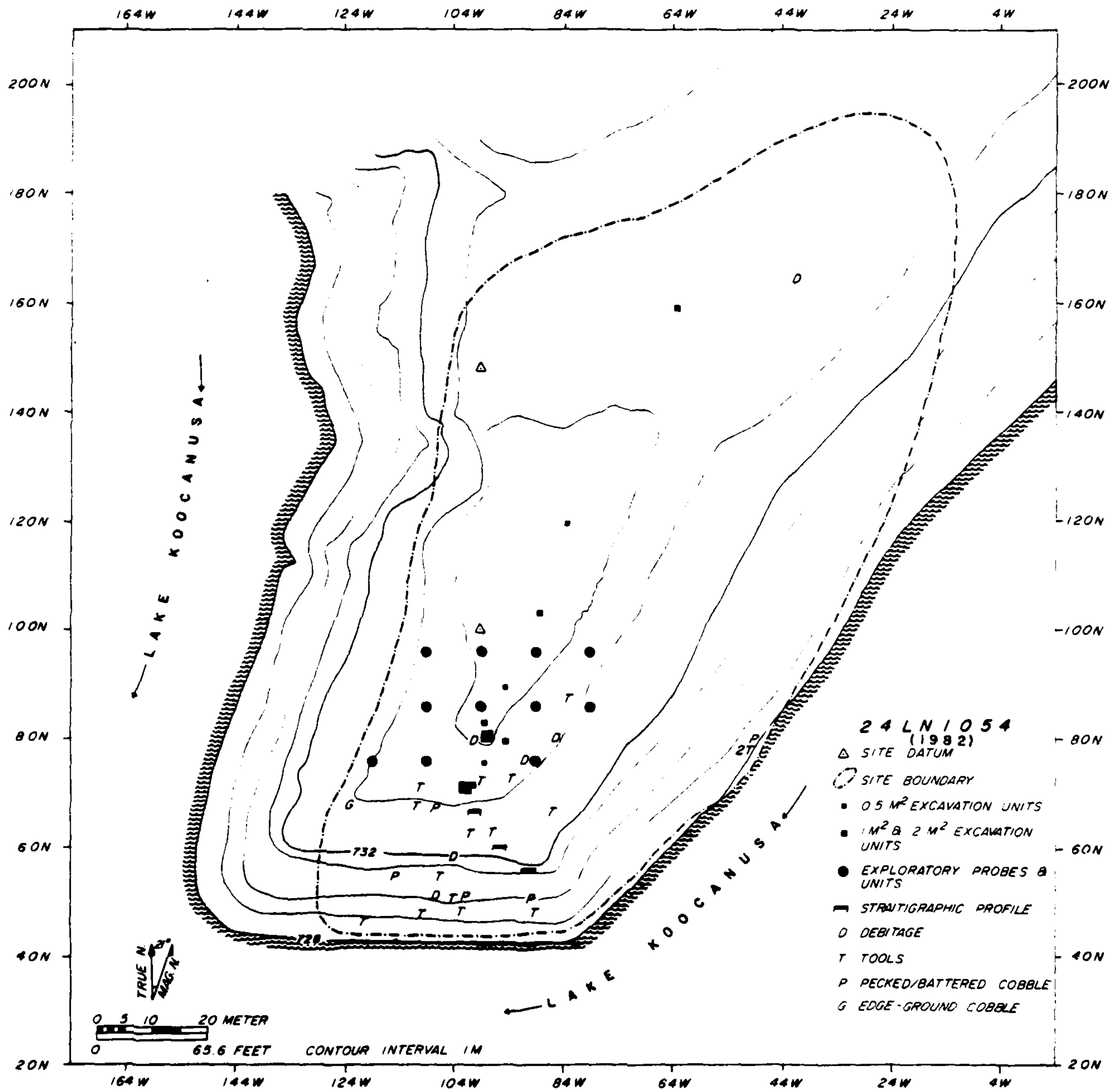


Figure 11-12. Map of 24LN1054 (1982), a high diversity site in the Bristow cluster.

General Nature of Cultural Materials

During the 1982 season cultural materials were observed scattered across a 180 x 100 m area (Figure 11-12). The inventory included flakes, bifaces, projectile points, edge modified flakes, cores, pecked and battered stones, edge-ground cobbles, unifaces, bones, unmodified cobbles, and fire-cracked rock. Discreet FCR features were not recognized in 1982 mainly because of previous extensive digging by pothunters and because the site was totally collected during the 1981 season. However, subsequent erosion had exposed thousands of artifacts. The greatest quantity and variety of materials was restricted generally to the southern end of the site. Isolated FCR densities ranged from high to very high for the southern portion, from medium to high for the central portion, and from very low to medium for the northern portion of the site.

Although quartzite was the dominant FCR material, mudstone, granodiorite and other materials were observed. Flaked lithic raw materials included a number of different cherts and a few pieces of obsidian. However, black fine grain mudstone and red quartzite were much more common.

Stratigraphy

Stratigraphy is discussed in Chapter 7 and Appendix G; here it is summarized briefly. Various sandy sediments characterize the stratigraphic profiles at 24LN1054 (Figure 7-10). The landform is covered sporadically by 2 to 30 cm of postreservoir (LKDII), fine sands. Underlying LKDII or directly on the surface, depending on the particular location in question, are from 2 to 20 cm of LKDI sediments. LKDI deposits overlay 10 to 30 cm of PMI or 15 to 40 cm of AMII deposits, again, depending on the particular location in question. PMI sediments were not present in the majority of the excavation units because they had been eroded, especially from the southern end of the landform. Between 20 and 200 cm of the underlying AMI deposits were examined. Bioturbation was evident for these well sorted sheet sands.

Cultural materials were generally confined to the upper 80 cm of the deposits. However, occasional specimens were recovered as deep as 120 cm below surface. Although cultural remains were collected from all the stratigraphic units, only a limited amount and variety of artifacts were recovered from the AMI unit.

Testing Rationale and Methods

As part of the 1981 field season, the entire site was surface collected using a grid unit (2 x 2 m) system. Unfortunately, the systematic collection was implemented after the site had been collected extensively and portions of it shovel skimmed and screened by pothunters (Figure 11-13). During the 1982 season, newly exposed cultural remains were marked with color-coded wire flags as a means to gain an

shorter duration (ca. 5,450-4,450 B.P.) than the "Bristow complex," but the hallmark artifact of the phase is a projectile point style reminiscent of the "Oxbow" type (Roll 1982:5.4-5.10). The "Oxbow" type is typologically the same as the "Type 11" projectile point in the LAURD system (Singleton 1982:I.26; Roll 1982:5.10) and the "large, eared, indented base" projectile point style described for this project.

Although a number of "Oxbow" points were recovered from sites in the Bristow Creek Cluster (e.g., 24LN365, 24LN1054, 24LN1055, and 24LN1059), many other point types, indicative of much later time periods also were recovered. Results of the lithic analyses conducted for this project also reveal that a bifacial reduction industry and a lack of ground and pecked stone tools are not readily apparent characteristics of sites in the Bristow Creek Cluster. Furthermore, it is apparent that locally available raw materials dominate almost all of the higher terrace sites, regardless of the kinds of projectile points recovered. It also should be noted that the kinds of "tool kit" artifacts reported to characterize the "Bristow complex" (Choquette and Holstine 1980:40-41) are characteristic of most, if not all other site clusters in the project area, including those that are under-represented by "Oxbow" points and over-represented by point styles indicative of much later time periods. Simply stated, the results of various analyses of materials recovered from the Bristow Creek area and reported here fail to support the idea of an extensive 8,000-5,000 year old workshop-campsite complex characterized by large tools, "Oxbow" points, and a predominately bifacial reduction technology. Two of the larger sites and those that were most productive in terms of the quantity of artifacts yielded (i.e., 24LN1054 and 24LN1058) are described in the following subsections.

24LN1054 (Sheila J. Bobalik)

This site is located in the central part of the Bristow Creek Site Cluster at an elevation of 2,410 feet (734.5 m) amsl. It lies on the end of a southwestern projection of T6 and has a southern exposure.

Bristow Creek, a perennial stream, is approximately 30 m below and 270 m south of the site. An ephemeral tributary separates 24LN1054 from 24LN1058. The stream was flowing regularly in late April of 1982 but not in late May. Numerous tree stumps on the denuded landscape indicate the area was covered by conifers.

The site area is disturbed extensively by logging, repeated fluctuations in the reservoir level and by pothunter diggings. Burned slash piles and construction spoil areas are visible across the terrace especially at the northern end of the site. Tailings from pothunter diggings are primarily restricted to the southern portion of the projection. Reservoir wave action has removed at least 30 cm of the prereservoir sediments and tree roots are exposed as much as 10-20 cm above the present ground surface. These disturbances are more extensive for the southern and western margins of the landform. Some areas of the site are covered by 2-30 cm of postreservoir sediments. Deposition is more extensive along the margins of the landform.

of the sites are classified as high diversity, 13 are low diversity sites, one (24LN1409) is a historic structure site (i.e., the remains of a log flume), and three of the sites are classified as "missing data." Two of the missing data sites--24LN1052 and 24LN1062--are aboriginal and 24LN1053 probably is, but available data do not permit a positive determination. Additional details about these and other sites are provided in Appendix C.

Most of the sites are situated on small, projecting landforms that are erosional remnants of bar/terrace landforms on the fourth through eighth terraces. In fact, almost every flat surface encompassing an area 10 x 10 m or larger in size exhibits cultural materials. Because some of the remnant landforms are small and/or steep sided, they have been subjected to intensive erosion as a result of reservoir drawdown and subsequent filling episodes. This erosion probably accounts for the fact that several sites (e.g., 24LN408, 24LN487, and 24LN1062) were recorded on rather steep slopes. Stated differently, it is probable that "sites" on steep slopes are the eroded and redeposited remnants of sites once situated on the flatter surfaces above the present location of the artifact scatter.

The Bristow Creek Site Cluster is of particular significance for several reasons. It has been known to pothunters, amateur archaeologists, professional archaeologists, and land managers for many years. As might be surmised, through the years many individuals have recovered artifacts from these sites. More than 20,000 artifacts were recovered from the sites during the course of the 1981 and 1982 field seasons, including several hundred collected by Corps of Engineers' personnel. At least 90 percent of the total came from 24LN1054 and 24LN1058.

Another important reason for focusing on sites in the Bristow Creek Cluster is because of the attention these particular sites have received in the regional archaeological literature. Some or all of the sites in what has been called an "extensive workshop-campsite complex" (which probably includes 24LN1054 and 24LN1058) are the type-site(s) for the "Bristow complex," an archaeological manifestation, typologically dated about 8,000-5,000 B.P. (Choquette and Holstine 1980:41). The kinds of artifacts that characterize the Bristow complex's "tool kit" include large side- and corner-notched points, as well as "eared" side-notched indented base points (resembling the Oxbow type of the Plains), "low angled" cores, bifaces, side-, end-, and discoidal scrapers, cobble and "block" choppers, utilized and marginally retouched flakes, cobble hammerstones, and edge abraded cobbles. Particularly outstanding characteristics of the Bristow complex include: (1) a bifacial reduction industry; (2) the large size of tools, suggesting that most were hand-held rather than hafted; (3) absence of ground and pecked tools; and (4) dominance of locally available raw materials in the artifact assemblage (Choquette and Holstine (1980:40). In establishing a local cultural sequence for the Kootenai Canyon area and vicinity (i.e., the Barrier Falls subarea) based on a projectile point chronology, Roll (1982) retained the word "Bristow" to designate the earliest named "phase." The "Bristow phase" is considered to be of

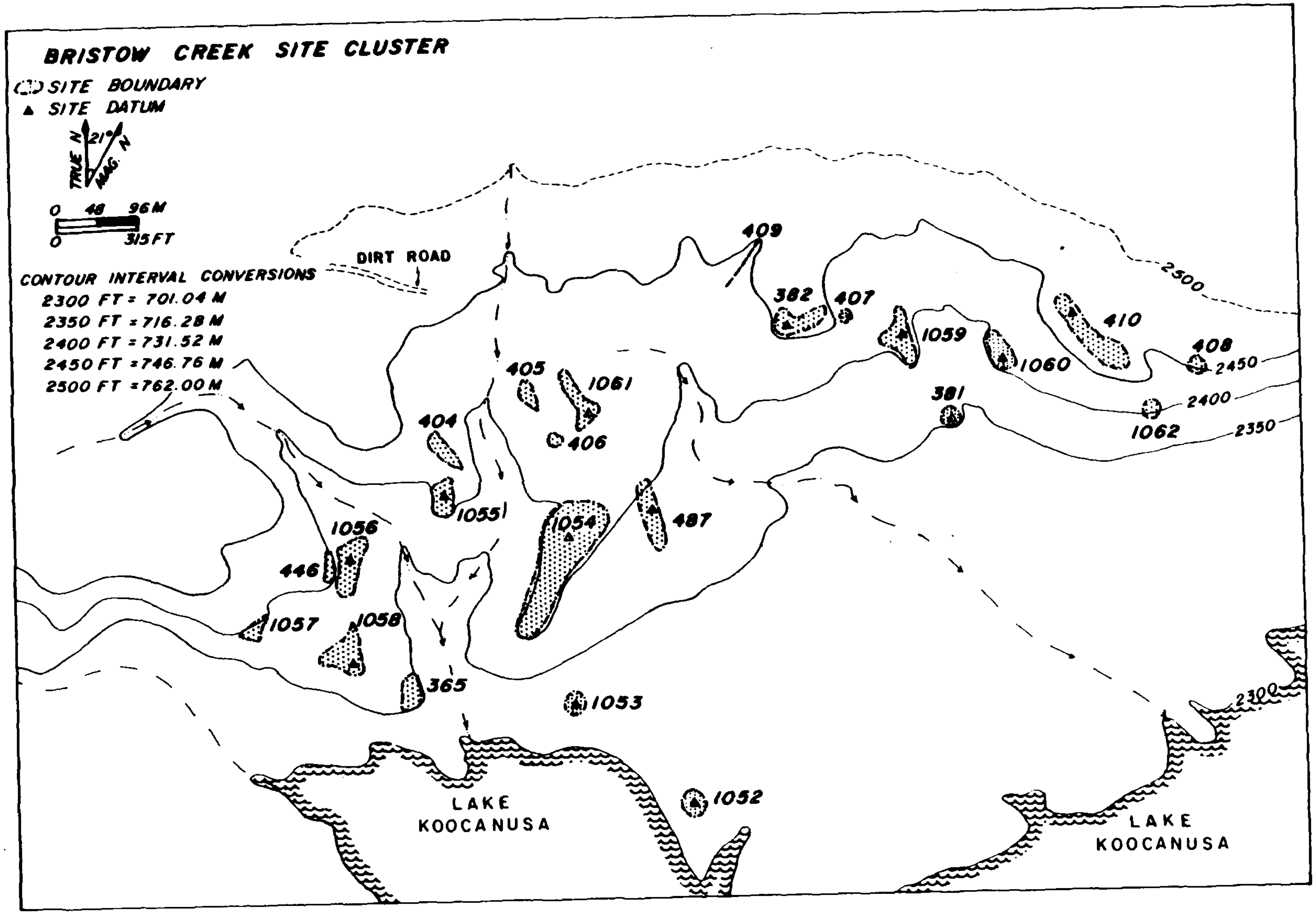


Figure 11-11. Map of the Bristow Creek Site Cluster, showing the location of 24LN1054, 24LN1058 and other sites.

Table 11-11. Inventory of Recovered Tools and Byproducts from Site 24LN388.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	144	36.92
Quartzite Flakes/Chips	80	20.51
Chert Flakes/Chips	9	2.31
Other, Small Flakes/Chips	75	19.23
Cobble Cores	11	2.82
Decorticated Cores	3	0.77
Bipolar Cores	1	0.26
Biface I and II	7	1.79
Shatter	16	4.10
Biface III	6	1.54
Biface IV	1	0.26
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	1	0.26
Edge Modified Flake/Chip	22	5.64
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	-	-
Late Middle Prehistoric Projectile Points	4	1.02
Early Middle Prehistoric Projectile Points	2	0.51
Dart Size Fragments	3	0.77
Early Prehistoric Projectile Points	-	-
Battered Stone	4	1.03
Ground Stone	1	0.26
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	390	100.00

A few flakes, isolated FCR and unmodified rocks were the only materials observed in the 2.25 m dog-leash units placed between FCR features. Several hundred pieces of flaked lithic debitage and more than 60 tools and cores were collected from 24LN388 (Table 11-11). A total of 37 bones and bone fragments were collected, but only one (a deer bone) was identified to species. All other bones were fragmentary and most were burned.

Interpretation

Cultural materials from 24LN388 were confined mainly to LKD deposits. The large quantity and variety of artifacts plus the large size of the site suggested extensive use of the area. It is suggested that the site functioned as a residential camp where a number of activities were undertaken. Lithic reduction appears to have been important. All stages of the reduction sequence are represented for locally available mudstones and quartzites. Chert artifacts are represented minimally by small, decorticated flakes and flaked lithic tools. Heavy-duty processing activities are represented by a number of thick, modified flakes, battered cobbles, and a ground stone artifact. Of special interest are the large number of thick, edge modified tools, including some adz-like specimens that may be indicative of wood working. The Biface III and IV specimens and a large number of thin edge modified flakes are indicative of comparatively light-duty activities. Burned and unburned bones were recovered from the FCR features and probably represent some kind of bone processing and/or use of bone as fuel, whether intentional or not. The southern exposure and the lack of permanent water in close proximity indicate a late winter/early spring occupation. The absence of arrow points, together with the presence of nine dart size projectile points, suggests that the site was occupied prior to 1500 years ago.

Bristow Creek Site Cluster

The group of sites on landforms overlooking the mouth of Bristow Creek in the Lower Canyon zone is an example of the characteristic clustering of sites at various places on the landscape, including but not limited to the mouths of major tributary streams (Figure 11-11). Other site clusters (Figure 6-1) occur near the mouth of the Tobacco River, near the mouth of Ten Mile Creek, north of Jackson Creek (the McGillivray Cluster), near the mouth of Cripple Horse Creek, and just south of that creek (Stuck Truck Cluster). Sites within any given cluster exhibit considerable variability and always, both low and high diversity sites are represented. It is of special note, however, that the landforms overlooking the mouth of Bristow Creek appear to have been utilized by aboriginal groups more intensively than any other location in the project area.

There are 26 recorded sites in the Bristow Creek Site Cluster, including three sites--24LN502, 24LN503, and 24LN525--adjacent to the prereservoir Kootenai River that were recorded by Taylor (1973). Nine

the site. The remaining exploratory excavation units were placed at 10 m intervals along two north-south lines. These were in the eastern part of the site where dense concentrations of surface material were observed.

Five of the 14 exploratory shovel probes were placed at 10 m intervals along an east-west line in the grass covered area. Nine of the probes were used to examine the tree covered, debris flow portion of the landform. Although these units were not screened, the matrix was carefully examined with a trowel. Depths of these units varied between 20 to 50 cm below surface.

Descriptive Results

The nine FCR features that received minimal documentation consisted of 4 to 36 pieces of FCR within a .7 to 2.0 m diameter area. Only one of these features yeilded flaked lithic artifacts. The 17 features that received more extensive surface treatment included 12 to 100 pieces of FCR within areas from 1.0 to 4.5 m in diameter. All of these were characterized by quartzite FCR, although other raw material types were present. In the majority of these features, over half of the FCR were smaller than 5 cm in size. However, most features contained FCR larger than 10 cm and unbroken cobbles. Ten features yielded flakes. A biface fragment and two burned bones were also recovered.

The surface planview map of one of the excavated features in the eastern part of the site indicated approximately 80 FCR within a 3.0 m^2 area. Subsurface materials included over 40 flakes, a corner-notched and barbed dart point and 16 pieces of FCR. These items were primarily from the upper 2 cm of the deposit although a few artifacts were recovered down to 10 cm below surface.

The other excavated FCR feature from the eastern portion of the site exhibited nearly 150 surface FCR within a 5 m^2 area. From the 2 x 2 m unit, 120 fire-cracked rocks were collected from the surface. Less than 10 pieces of FCR, 2 flakes, and a medium stemmed, concave base projectile point were the only subsurface materials associated with this feature. These artifacts occured between 0 to 10 cm below the surface.

The smaller feature excavated in the western part of the site consisted of approximately 40 surface FCR within an area 1.6 m in diameter. Subsurface materials consisted of nearly 150 pieces of FCR, about 20 pieces of burned and unburned bone and a biface. A few artifacts were recovered to a depth of 20 cm below surface, but they were associated with a tree burn and krotovina (i.e., rodent burrow).

Quartzite was the dominant FCR material at all three of the excavated features. Except for the one feature associated with an obvious tree burn, there was no indication of an oxidized matrix. In addition, no evidence of pit stratigraphy was observed.

In an attempt to discern horizontal differences in artifacts and increase the sample size, two portions of the site were gridded and all cultural material (except FCR) within each unit was collected. A 40 x 4 m collection transect was placed near the eastern portion of the site in a high artifact density area. Another 40 x 4 m unit was located in the east-central portion of the landform in an area of medium artifact density. These were divided into 2 x 2 m segments and the surface artifacts were collected separately for each segment. These linear units were oriented north-south so as to sample several of the modern reservoir strand lines and the grass covered area at the northern portion of the site.

The provenience, number of pieces of FCR, associated flaked or nonflaked lithic artifacts and diameter of the concentration were recorded for all 29 FCR features. Subsequently, 17 of these features received more extensive treatment. Material type was noted and associated artifacts (excluding FCR) were collected. Pieces of FCR were tabulated according to three size grades (i.e., the standard size grades used throughout the project: 0-5 cm, 5-10 cm, and greater than 10 cm) and a piece of FCR typical of each size grade, was weighed. For nine of the smaller FCR features, a 1.15 m radius dog-leash unit was used. A 2.25 m radius dog-leash was superimposed over eight of the larger FCR features. In addition, three of the more intact FCR features were excavated to assess integrity and associated artifacts. Four 2.25 m dog-leash units were used to sample between FCR features. These surface units were placed between fairly intact FCR features located along the eastern margin of the site.

Subsurface investigations included three 2 x 2 m units, a 1 x 1 m unit, a 1 x .5 m unit, 29 posthole units, and 14 exploratory shovel probes. In addition, six 8 cm auger holes were dug for stratigraphic information. The three 2 x 2 m units were used to examine features from the western area of the site more extensively. Artifact provenience was by 1 x 1 m quad within each 2 x 2 m unit. Due to time limitations, these units were terminated after excavating below the feature. Depths varied from 10 to 20 cm.

The 1 x 1 m and 1 x .5 m units were placed in a vegetated portion of the landform in an attempt to recover relatively undisturbed cultural materials. These units also were dug in 10 cm levels and terminated after excavating below the suspected culture bearing deposits. The 1 x 1 m unit was terminated at 190 cm whereas the 1 x .5 m unit was excavated to 130 cm below the surface. For stratigraphic purposes, the 1 x .5 m unit was subsequently expanded to 1 x 1 m and dug without screening the sediments to a depth of 3.3 m below the surface (see profile in Figure 7-10).

In an attempt to confirm the suspected site boundaries and to determine the extent of erosion and postreservoir dis' ance, a series of exploratory excavation units and probes were dug. The 20 cm diameter exploratory excavation units (postholes) were dug and screened in 20 cm levels to a maximum depth of 100 cm. Thirteen of these units were placed at 20 m intervals along an east-west line in the northern part of

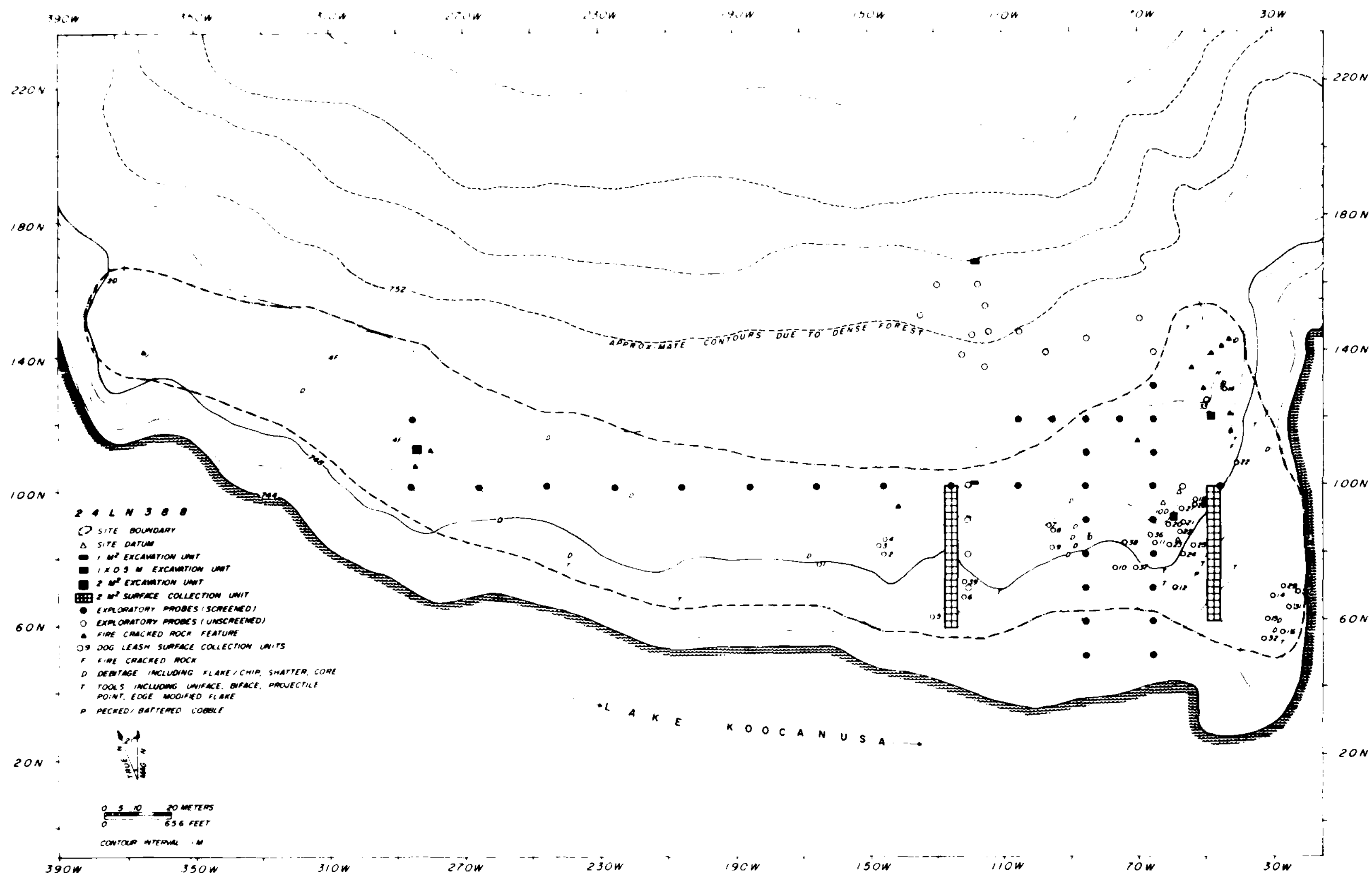


Figure 11-10. Map of 24LN388, a high diversity site.

the outer edge of the landform by repeated fluctuations in the reservoir level. Erosion is even more extensive downslope, adjacent to the southern and eastern margins of the site.

General Nature of Cultural Materials

Cultural remains were scattered across a 350 x 100 m area and included flakes, projectile points, bifaces, edge modified flakes, cores, battered cobbles, bone, a piece of ground stone, a uniface, and a modern bullet casing. Also, isolated FCR and numerous features were observed. Most of the artifacts and features were concentrated within a 80 x 80 m area along the southeastern margin of the landform (Figure 11-10). Artifacts were generally restricted to the denuded area immediately above and on the modern strand lines. Even though the vegetated areas adjacent to the drawdown zone were examined carefully, few artifacts were found there. Both the number and variety of artifacts decreased from east to west across the site. Isolated FCR densities ranged from high to very high for the eastern portion of the landform and from medium to high for the central area. For the western portion of the site, FCR densities varied from very low to low.

A wide range of flaked lithic raw material types was observed in the eastern part of the site, but there was a concentration of black mudstone artifacts in the northeastern corner of the site. Elsewhere mudstones dominated and quartzites were represented in moderate numbers. Only a few chert artifacts were noted. Quartzite was the dominant FCR material, but other types were present in moderate frequencies.

Stratigraphy

Much of the denuded portion of the landform was covered by 2-20 cm of postreservoir (LKDII) fine sands. LKDI sediments varied between 3 to 45 cm in thickness. Approximately 10-90 cm of the PMI unit was examined. Underlying PMI were 5-60 cm of AMII sediments. Up to 50 cm of AMI sediments which underlie the AMII deposits also were examined. Bioturbation was evident for the sheet sands which are mixed with underlying fan and solifluction deposits (see Chapter 7, especially Figure 7-10). Cultural materials were restricted to the upper 20 cm of the deposits. However, almost all material was collected between 0 to 10 cm below surface in the LKD deposits.

Testing Rationale and Methods

Cultural remains were marked with color-coded wire flags during a systematic survey of the site. Given the large quantity of surface material, only select artifacts were provenienced and collected. These items included all tools and debitage representing unusual material types. The density of isolated FCR was recorded for 20 x 20 m area.

Descriptive Results

A preliminary analysis of the distribution of surface artifacts at 24LN1054 was carried out following the 1981 field season. Density distribution patterns were determined for fire-cracked rock, flaked lithic debitage, and bone fragments. The locations of selected artifact types (using preliminary designations) were plotted (Figure 11-14).

Although distribution patterns have not been analyzed thoroughly, it is evident that cultural materials were concentrated more in the southern half of the site. It must be recognized that not only had the surface been picked over and shovel skimmed by pothunters, but reservoir caused erosion removed varying quantities of sediments. The result is that cultural materials representing thousands of years of use of this landform were artificially deposited on a single surface. For the surface artifacts it appears as if FCR and the flaked lithic tools are associated spatially. Interestingly, lithic debitage and bone fragments also seem to be associated spatially (Figure 11-13). These patterns may well be the result of the extensive and intensive pothunting activities. At most other sites in the project area FCR, bones, lithic tools, and debitage co-occur.

Results of the 1982 field investigations indicated that although the site's surface had been disturbed severely, a fairly large number and variety of artifacts remained undisturbed in subsurface deposits. This was especially the case for the southern portion of the landform.

A total of 18,856 lithic artifacts (including those collected prior to 1981 by Corps' archaeologists) was recovered and analyzed. Unique artifacts as well as examples of every tool type recovered from the project area were found at 24LN1054 (Table 11-12). The grooved stone artifact (Figure 8-21,b) that looks like a tiny maul, but exhibits no evidence of being used as one, is an example of a "unique" artifact. A piece of flat copper, probably part of a pendant similar to the historic age specimens reported by Taylor (1973:107-109), is another example of the one-of-a-kind artifacts recovered from 24LN1054. The copper fragment came from an excavation unit 30-40 cm below the surface in AMII sediments; it was presumed to be intrusive, probably as a result of cryoturbation and/or bioturbation.

Nearly 50 flakes, a uniface, a biface and a few FCR were recovered from nine of the exploratory probes. Although these materials were primarily from the LKDI or PMI units, a few flakes were recovered in the AMII and AMI units. A variety of artifacts were recovered from all the .5 x .5 m, 1 x 1 m, and 2 x 2 m units. The greatest quantity and variety of artifacts came from the LKDI and AMII stratigraphic units. However, over 300 items including one projectile point, two bifaces, three edge modified flakes and numerous peices of debitage were collected from the underlying AMI deposits (Table 11-13).

Judging on the basis of flakes and chips recovered in an excavation context from unmixed analytic (stratigraphic) units, lithic material percentages appear very consistent through time (Table 11-14). Mudstone

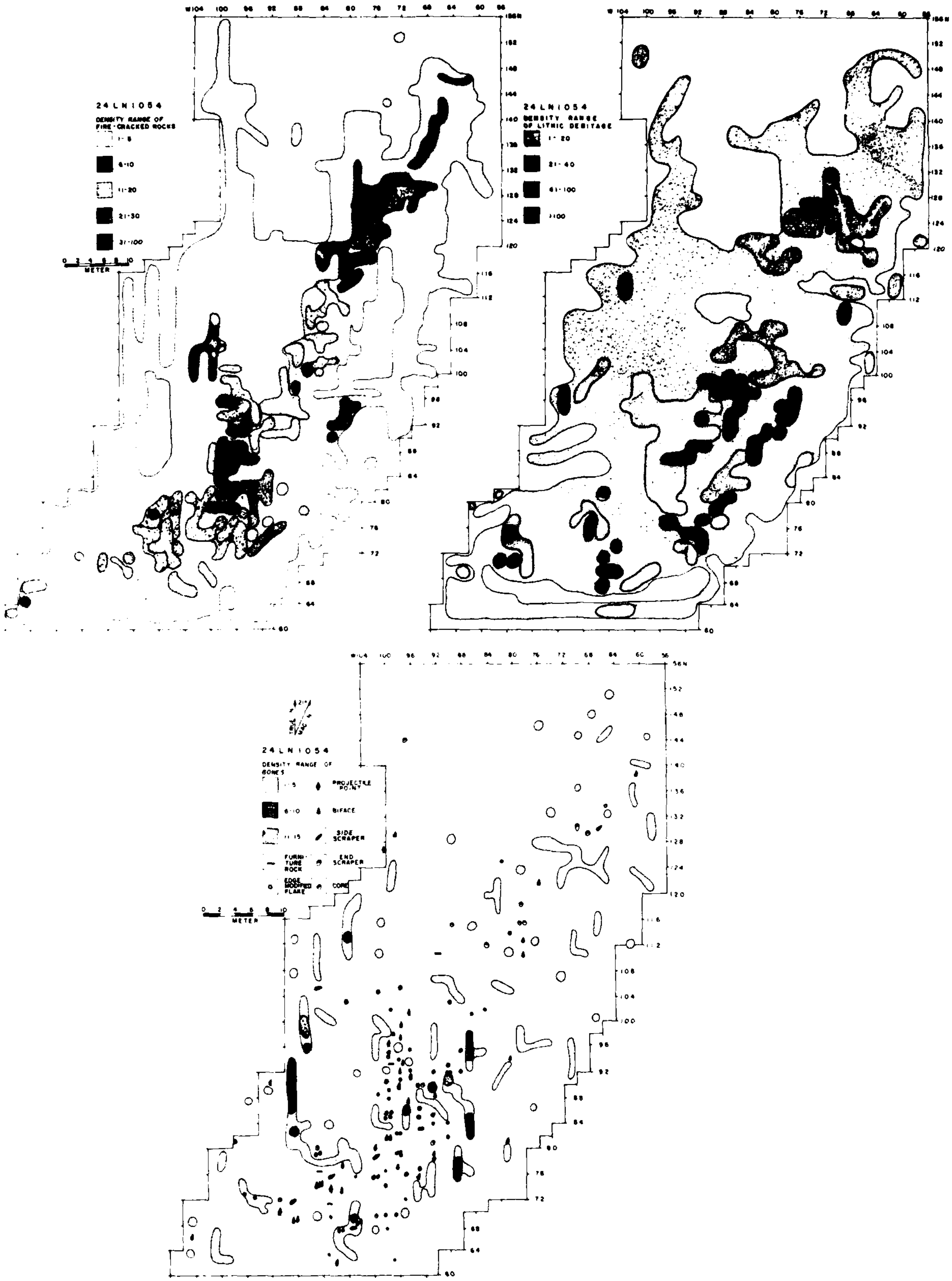


Figure 11-14. Cultural materials distribution and density maps for 24LN1054.

was the dominant material type; 66 percent of the flakes and chips from PMI sediments were mudstone, as were 64 percent of the items from AMII sediments, and 66 percent of those from AMI sediments. Black fine grain mudstone was the most numerous subcategory, as is characteristic for almost all sites. Quartzite percentages for these three stratigraphic units vary between 27 and 29 percent. Chert percentages range between 6 and 9 percent for these three units. The occasional obsidian flakes are from AMII and LKDI sediments.

The dominance of mudstone also is apparent for cores and tools recovered from the subsurface. Most of the cores and modified flakes are mudstone. Chert tools are the rarest. Numerous edge modified flakes and a single uniface were made from chert. Of the 32 bifaces, only three are chert and nine are quartzite. Three of the nine projectile points from an excavation context are made of chert.

Two of the pecked stone artifacts recovered from AMII sediments (i.e., those older than 6,700 years based on the result of the glass shard analysis) deserve mention. One of the artifacts is the proximal or small (non-bit) end of a cylindrical shaped pestle. The other one is the small full-grooved, maul-like artifact. These two specimens are the kinds of artifacts often considered to be diagnostic of time periods later than 6,700 years ago, yet they were recovered from sediments judged to be older than 6,700 years old. Whether these artifacts were displaced by bioturbation or cryoturbation or whether they are in situ or represent lag deposits from an erosional event remains to be determined. It is of course possible, though not very probable, that the results of the glass shard analysis are in error.

Although a large number of artifacts were recovered from 24LN1054, only 3,960 came from an excavated context, and of those, 2407 (or 70.1%) were recovered from unmixed analytic units. Because of extensive erosion many 10 cm excavation levels encompassed in situ and/or LKD deposits. Other 10 cm levels also were mixed because they included portions of two analytic units (e.g., AMII and AMI) and accurate separation of artifacts accordingly was impractical because of the diffuse boundary between units. However, by examining the distribution of artifacts recovered only from unmixed units, it is possible to reduce error caused by excavation procedures, but this approach does not mitigate against the effects of bioturbation and cryoturbation.

Fewer than 10 tools were recovered from unmixed PMI and AMI deposits, but more than 40 were recovered from AMII sediments (Table 11-13). Other than those differences most likely to be accounted for by sample size, the distribution of artifact types does not seem to differ greatly among the three analytic units. As noted earlier, obviously significant differences in the frequencies of raw material types are not apparent either, even when subdividing raw material types according to texture or translucence (Table 11-14).

The kinds of projectile points and bifaces recovered from unmixed analytical units are similar in most respects, but there are some differences (Table 11-15). Tool types are similar in that almost all of

Table 11-13. Frequencies for Morphological/Technological Artifact Types Recovered from Unmixed Analytical (Stratigraphic) Units at 24LN1054.

Analytical (Stratigraphic) Units	Flakes/ Chips (Number)	Shatter (Number)	Cores (Number)	Edge Mod. Flakes Cobbles, Unifaces (Number)	All Bifaces (Number)	All Projectile Points (Number)	Battered Stone (Number)	Pecked Stone (Number)	Total (Number)
PMI (generalized post-Mazama Age)	179	69	0	3	2	2	0	0	255
AMII (late pre-Mazama Age)	1,521	277	3	20	11	7	1	2	1,342
AMI (early pre-Mazama Age)	230	73	0	3	2	2	0	0	310

Table 11-14. Frequencies of Raw Material Types, Recovered from Unmixed Analytical (Stratigraphic) Units at 24LN1054.*

Analytical (Stratigraphic) Units	Quartzite (Med. Grain) N	%	Quartzite (Coarse Grain) N	%	Mudstone (Fine Grain) N	%	Mudstone (V. Fine Grain) N	%	Chert (Opaque) N	%	Chert (±Translucent) N	%	Totals (Row) N	%
PMI (generalized, post-Mazama Age)	67	26.8	5	2.0	148	59.2	16	6.4	10	4.0	4	1.6	250	12.1
AMII (late pre-Mazama Age)	394	24.9	36	2.3	882	55.8	122	7.7	96	6.1	50	3.2	1,580	76.5
AMI (early pre-Mazama Age)	64	27.1	2	0.9	147	62.3	9	3.8	9	3.8	5	2.1	236	11.4
TOTALS (Column)	525	25.4	43	2.1	1,177	57.0	147	7.1	115	5.6	59	2.8	2,066	100.0

*This table excludes flakes/chips in the other/small flakes category; 5 flakes/chips are excluded from the PMI total; 262 from the AMII units, and 74 from the AMI unit; of these only 4 are made from another material (obsidian) all of those were from the AMII unit; all the others are small (less than 0.5 cm) size waste flakes and shatter recovered from fine screening.

Table 11-15. Tabulation of Projectile Points and Bifaces Recovered from Unmixed Analytical (Stratigraphic) Units at 24LN1054.

Analytical Unit	Artifact Catalog No. (24LN1054-....)	Morphological/Technological Tool Type (Morpho/Functional Tool Type)
PMI	429	Large side-notched point (dart size point)
(generalized	435	Large side-notched point (dart size point
Post Mazama	432	Single side-notched biface (thin biface)
Age)	427	Biface IV, pointed end (thin biface)
AMII	1199	Large lanceolate shape point (dart size point)
(late pre-	1200	Large side-notched point (dart size point)
Mazama Age)	1202	Large side-notched point (dart size point)
	1205	Large,"eared,"indented base point (dart size point)
	1209	Dart size haft element (dart size point)
	1211	Dart size haft element (dart size point)
	1207	Dart size blade fragment (dart size point)
	1195	Biface IV, pointed end (thin biface)
	1203	Biface IV, triangular (thin biface)
	1210	Biface III, pointed end (thin biface)
	466	Biface III, ovoid/rectangular (thin biface)
	1214	Biface III, ovoid/rectangular (thin biface)
	1216	Biface III, ovoid/rectangular (thin biface)
	1239	Biface III, ovoid/rectangular (thin biface)
	1241	Biface III, ovoid/rectangular (thin biface)
	442	Biface III, ovoid/rectangular frag. (thin biface)
	1228	Biface III, undetermined fragment (thin biface)
	1232	Biface III, undetermined fragment (thin biface)
AMI	1197	Large stem, concave base point (dart size point)
(early pre-	436	Arrow size blade fragment (arrow size point)
Mazama Age)	1259	Biface III, ovoid/rectangular (thin biface)
	1246	Biface III, ovoid (thick biface)

Table 11-16. Inventory of Time Period Markers for Site 24LN1054.

Time Period/Classes	Quantity Absolute	Quantity Relative
Historic Aboriginal		
Copper	1	1.6
Late Prehistoric Period		
Small, Side-Notched Points (Figure 8-10, a-f)	2	3.3
Small, Corner-Notched Concave Base Points (Figure 8-10, 1-p)	4	6.6
Small, Corner to Side-Notched Points (Figure 8-10, q-t)	1	1.6
Small, Corner-Notched and Barbed Points (Figure 8-10, g-k)	3	4.9
Small, Arrow Size Point Fragments	2	3.3
Subtotal	12	19.7
Late Middle Prehistoric Period		
Large, Short Stemmed Points (Figure 8-12, a-b)	1	1.6
Medium, Corner to Side-Notched Points (Figure 8-11, g-l)	1	1.6
Large, Stemmed, Straight Base Points (Figure 8-11, m-o)	--	--
Large, Wide Notched Points (Figure 8-11, p-s)	4	6.6
Large, Corner-Notched and Barbed Points (Figure 8-12, i-j)	1	1.6
Medium, Stemmed, Concave Base Points (Figure 8-11, a-f)	1	1.7
Large, Indented Base Points (Figure 8-12, k-m)	2	3.3
Subtotal	10	16.4
Early Middle Prehistoric Period		
Large, "Eared," Indented Base Points (Figure 8-13, a-j)	11	18.1
Large, Side-Notched Points (Figure 8-14, f-l)	6	9.8
Subtotal	17	27.9
Generalized Pre-Late Prehistoric		
Medium and Large Dart Size Point Fragments	15	24.6
Early Prehistoric Period		
Large, Lanceolate Shaped Points (Figure 8-14, a-e)	3	4.9
Large, Stemmed, Concave Base Points (Figure 8-13, k-o)	3	4.9
Subtotal	6	9.8
TOTAL TIME PERIOD MARKERS	61	100.0

the projectile points are the large, dart size types considered to represent the Early and early Middle Prehistoric periods. Furthermore, Biface III and IV artifacts (i.e., thin bifaces) are well represented, almost to the exclusion of Biface I and II (i.e., thick bifaces). The differences in tool types among the units may be due to sampling error and/or bioturbation and cryoturbation, but it is interesting to note that on the whole the vertical distribution of projectile point styles conforms reasonably well to traditional expectations. If the arrow size blade fragment from the AMI sediments is classified accurately, there is not much doubt that it is out-of-place, probably as a result of the disturbance processes mentioned above. The large stem, concave base point from the AMI unit probably would be classified as a Windust or Pryor Stemmed point. The large, "eared," indented base point from AMII deposits is "Oxbow", while the large, lanceolate shape point (a proximal fragment with well ground lateral edges), likely would be referred to as some kind of late Paleo-Indian or early Archaic style characteristic of the Plains areas. The large, side-notched points from the AMII and PMI units might be classified as Bitterroot Side-notched points, considered to be characteristic of much of the intermountain area 7,000-5,000 years ago or so.

The intention here is not to argue that 24LN1054 contains extremely well stratified and temporally distinct cultural deposits. The number of burned tree roots, rodent borrows, and frost features demonstrates clearly that the site is not in pristine condition. However, even a cursory examination of the data presented in the tables in this subsection demonstrates that, on the whole, the assemblage of artifacts recovered from the subsurface differs quantitatively and qualitatively from the surface materials. The artifacts recovered from the surface certainly appear to be younger, on the whole, than those recovered from the subsurface.

A total of 697 faunal remains was collected from 24LN1054 (see Chapter 9 and Appendix E for detailed descriptions). These remains include 13 land snail shells, three river mussel shell fragments, two very small mammal (i.e., rodent) bones, and a bone identified as Felidae (cat family). With the exception of the river mussel shells, these remains appear to be intrusive. The remaining bone material including the Leporidae, Cervidae, Canis lupus and Ovis is archaeological (i.e., culturally and temporally associated with the other archaeological remains). Most (91.1%) of the faunal remains are fragmentary and small in size (less than 2 cm). Only 248 items (35.6%) have been burned in a manner similar to burned bone elsewhere in the project area (i.e., in an intense fire producing calcine, white to gray, bone).

Interpretations

Judging by the number and variety of projectile points recovered from the site, the Early and/or early Middle periods are best represented as indicated by the presence of large side-notched, large "eared" indented base, large stemmed, concave base, and large lanceolate types of projectile points. These point styles account for 23 or 51.1

percent of the 45 diagnostic points recovered from the site (Table 11-16). Although these types were found on the surface and in subsurface deposits, almost all the relatively complete projectile points from unmixed deposits were the kinds considered to represent the Early and/or early Middle periods. Late Middle Period projectile points account for 11 or 24.4 percent of the identified point types. These styles (e.g., large indented base, large wide notched, and medium corner- to side-notched points) were all recovered from the surface or LKD deposits. Late Prehistoric Period arrow size points (e.g., small corner-notched concave base, small corner-notched and barbed, and small side-notched points) occur in the same frequency as do late Middle Period styles. All but one of the arrow size points were recovered from surface and near-surface deposits. It has been argued that the single arrow point size blade fragment and the copper artifact, both of which were recovered from AMII deposits, are displaced artifacts that moved down in the profile as a result of bioturbation and/or cryoturbation. This is a reasonable conclusion given the character of the sediments at the site and considering that almost all other diagnostic artifacts from subsurface deposits are much older than arrow points and copper pendants are thought to be in this area. The pestle fragment and small maul-like artifact recovered from AMII sediments may or may not be temporally associated with early Middle Period projectile points. However, with available data, it would be difficult to argue that these artifacts could not easily be part of an early Middle Period artifact assemblage.

Site 24LN1054 yielded more kinds of artifacts than did any other site in the project area and this provides ample evidence that a wide range of activities were carried out there. Artifacts considered to be representative of heavy-duty tasks--nonflaked lithic tools, Biface Is and Biface IIs, and thick edge modified flakes--are abundant. But heavy-duty task artifacts appear to be more common in the surface and near-surface (i.e., younger) deposits. However, they do occur in the unmixed analytic units. Artifacts considered to have been used for light-duty tasks--Biface IIIs and Biface IVs, projectile points, and thin edge-modified flakes--are even more abundant. Widespread, if not abundant, quantities of faunal remains attest to the importance of processing game animals at the site. The large number of cores, most of which are cobble or decorticated cores as opposed to bifacial cores, and waste flakes, as well as the many unfinished and broken tools, provide ample evidence for all stages of lithic reduction. The pestles, facially ground and edge-ground tools may be evidence that vegetal processing also occurred at the site.

Given the great diversity in artifact types it is likely that the site functioned as a short-term residential camp, used during various seasons of the year, at one time or another. Its proximity to permanent water certainly suggests it could have been occupied during the dry season (summer and fall) and the nearly intermittent streams would facilitate occupation during the winter and spring.

To summarize, 24LN1054 yielded more artifacts than did all the other sites on higher terraces. It appears to have been occupied for at least 8,000 or 9,000 years, if not longer. For most of that time, the

site probably functioned as a residential camp, occupied during various seasons of the year. There is no readily apparent reason to think that it was occupied by very large numbers of people at any one time. Repeated, short-term occupations over thousands of years, by small groups of highly mobile families, engaged primarily in hunting, is a parsimonious explanation for the very high density and diversity of cultural materials at 24LN1054. It is clear, however, that 24LN1054 was a favored, perhaps one of the most favored, campsite in the area. This may be an indication that for thousands of years food resources were abundant in the immediate vicinity of Bristow Creek and/or that Bristow Creek is a kind of "central place" that provided ready access to a number of important resource areas.

24LN1058 (Lynne MacDonald)

This site is located in the southwestern part of the Bristow Creek Site Cluster. It lies at a lower elevation (2,377 feet amsl) than does 24LN1054, but 24LN1058 is also situated on T6 (Figure 11-15). The site has a southeastern solar exposure. Distances to permanent and intermittent water sources are similar to those for 24LN1054.

Portions of the site area have been extensively damaged by reservoir related activities. Use of heavy equipment and slash piling and burning during logging has impacted the surface in the central portion of the terrace, at the north end of the site. Wave action has cut away the terrace edge, leaving lag deposits of cultural material on the slopes. As much as 20-30 cm of sediments have been stripped from much of the site surface, and the upper 10-20 cm has been mixed and churned by wave action. In 1981 there was evidence of pothunters'surface collecting and digging/screening at the site, though it was not nearly as extensive as at 24LN1054. Evenso, intact cultural deposits remain below the disturbed zone.

General Nature of Cultural Materials

In 1982, between 5 and 15 cm of LKDII sediments cover portions of the site. Therefore, surface visible cultural materials were confined largely to the wave cut edges of the site. However, the general scatter of artifacts encompassed approximately 8,000 m^2 (Figures 11-15 and 11-16). Material was moderate (5-20 items/400 m^2 area) to dense (over 20 items/ 400 m^2 area) around much of e :ern and southern perimeters of the terrace, and sparce along the west ıace. Cultural material eroding along the east face was principally small mudstone and chert flakes, larger flakes of medium grain, black to grey quartzite, and large flakes and/or chunks of a red, coarse grained quartzite. Material types visible along the south edge of the site were similar, but chert was not as abundant.

Fire-cracked rock was visible only on the southeast point of the site, in an area approximately 600 m^2. Most of the FCR was scattered, but several rather tight clusters remained on the eroded surface (Figure

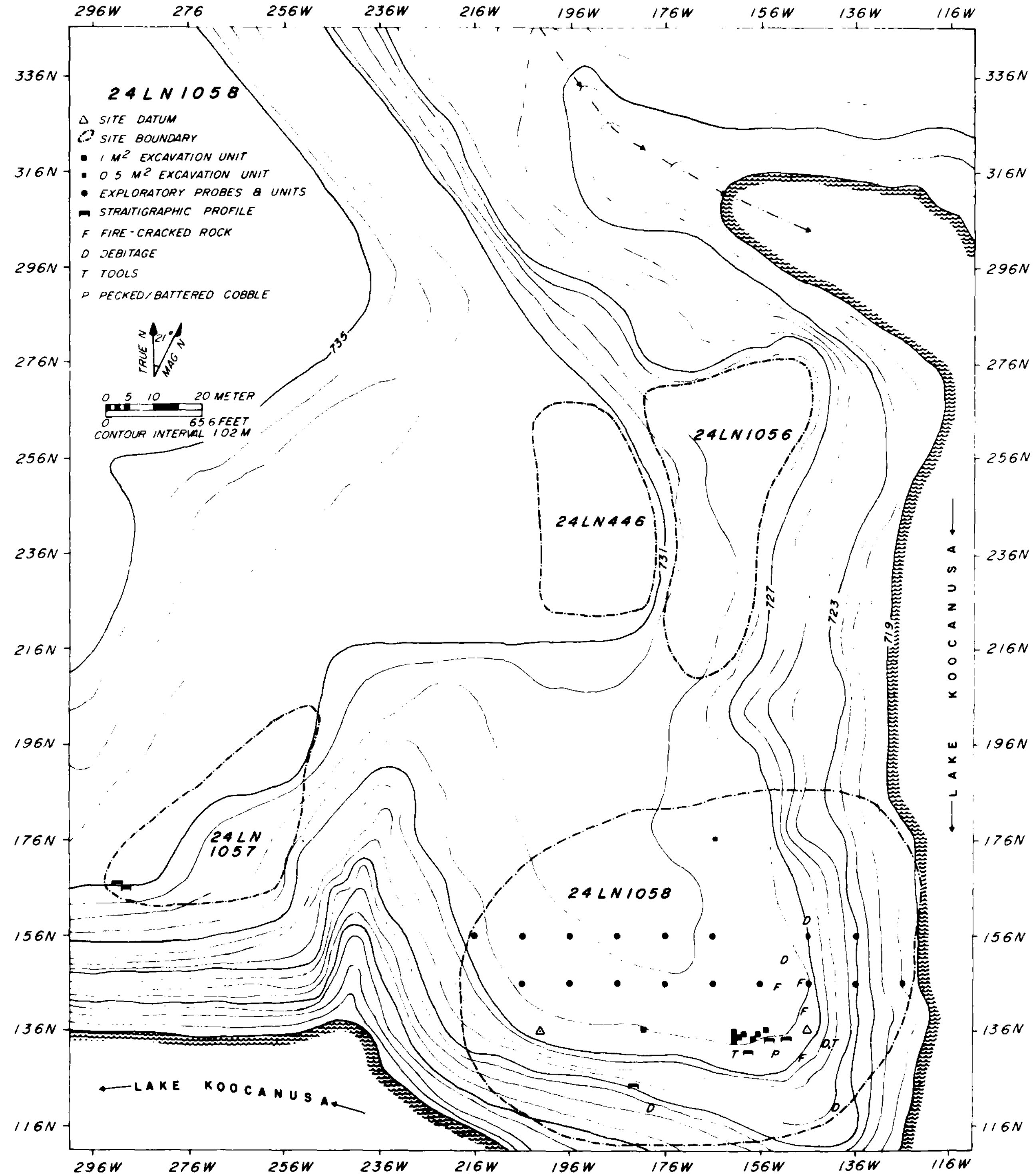


Figure 11-15. Map of 24LN1058, a high diversity site in the Bristow site cluster.

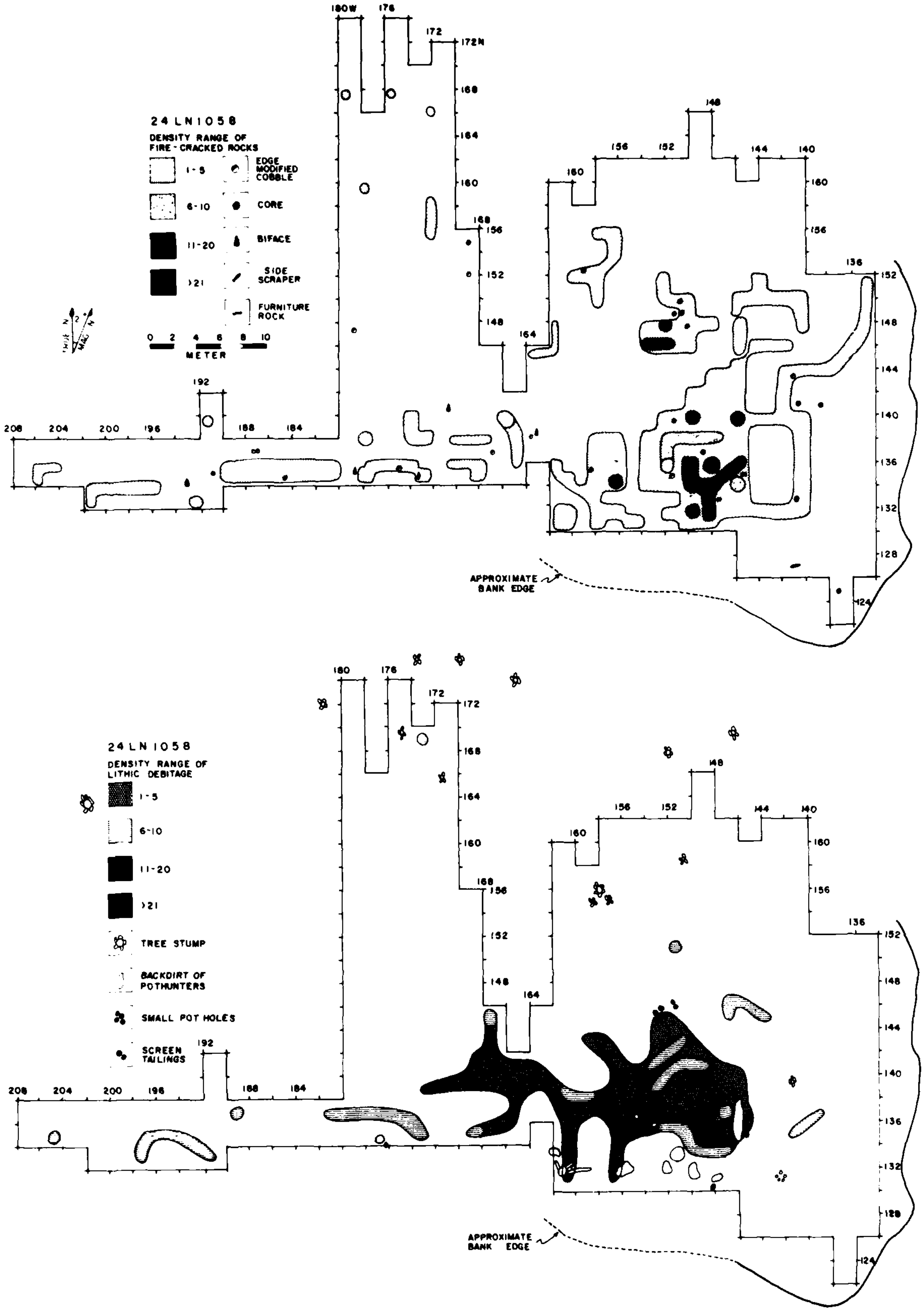


Figure 11-16. Cultural materials distribution and density maps of 24LN1058.

11-16). Most FCR was coarse grained quartzite. Flakes were scattered throughout the FCR area. Faunal materials also were present on the surface of the site.

A number of large (greater than 10 cm in size), unmodified cobbles were noted in the east half of the south-facing cutbank between 10 and 20 cm below surface. Naturally occuring cobbles are found 20 m downslope, but those outcropping in the cutbank were clearly cultural.

Stratigraphy

The sedimentary sequence at site 24LN1058 was consistent among most test units. All commenced with LKDII and/or LKDI, followed in most cases by a PMI deposits beginning between 10 and 30 cm below surface. All units that contained an AMII deposit were underlain by an AMI unit. The former usually began at 30-40 cm below surface, although some units contained AMII deposits within 10 cm of the surface. AMI units usually began at 70-80 cm below surface.

Several units excavated at the site contained involutions or frost-related features in AMII sediments extending into the AMI deposits (see Chapter 7, especially Figure 7-10). The AMII stratum contains the densest subsurface cultural deposits at the site, but all AMI sediments that did not contain intrusive frost features were culturally sterile.

Testing Rationale and Methods

Initial field work was carried out at site 24LN1058 in 1981. The site was gridded in 2 x 2 m units and all cultural materials visible on the surface were collected. FCR was subsequently weighed and discarded. A 1 x 1 m test pit was excavated in the area of the densest surface deposits. Between the 1981 and 1982 field seasons considerable erosion occurred at the site and exposed more cultural material. In 1982, additional, but limited surface collection and extensive subsurface recovery activities were conducted to further delimit and assess the site's cultural deposits.

First, an intensive surface survey was conducted and all isolated artifacts and/or concentrations of cultural materials were flagged. Modified flakes and other tools and examples of uncommon lithic materials were point provenienced and collected. A complete surface collection was deemed unnecessary due to the extent of collections the previous year.

Initially, exploratory probes (unscreened trowel tests) were made to determine the location of extensive subsurface disturbance from slash piling and burning so the areas could be avoided during the remaining testing effort. Four .5 x .5 m exploratory excavation units were arbitrarily located along established grid lines in areas relatively free of disturbance (see Figure 11-14). All units were excavated to 30 cm below the last cultural material and/or until encountering sediments

unlikely to yield additional material (e.g., lacustine deposits). In addition, 17 postholes, arranged in two east/west lines, were excavated to 1 m below surface. These probes were designed to determine the horizontal and vertical extent of cultural material at the site.

Ten 1 x 1 m units were excavated along the south edge of the site where surface evidence and test information indicated the densest cultural deposits occurred. Initially, three of these 10 units were excavated to approximately 150 cm below surface to gain a larger sample of site material and to discover deeply buried deposits. Also the 1981 test unit was opened and excavated to a greater depth. Later, five 1 x 1 units were excavated immediately north of the cobble feature visible in the south cutbank. Buried rock concentrations had not been discovered previously at any of the tested sites.

Descriptive Results

The materials recovered from the surface of the site in 1981 were analyzed during the period between field seasons and their distributions were plotted on surface maps (Figure 11-16). As in 1982, most of the surface cultural materials were concentrated in the southeastern part of the site and along the southern cutbank. In general, the distribution maps indicate that FCR, flaked lithic debitage, and tools are associated spatially. However, the extensive pothunting activities at the site may have obscured some patterns. The materials recovered in 1981 and 1982 are all listed in Table 11-17. The following discussion focuses on the nature of cultural materials recovered from the subsurface.

Test excavation results indicate that most of the subsurface cultural material is concentrated along the southeast edge of the landform. A few flakes were recovered from a .5 x .5 unit and two lines of postholes at 156 and 146 north on the site grid (Figure 11-16). Of the two .5 x .5 m units excavated at 176 north, one was sterile and the second yielded a single FCR at 10-20 cm below surface in LKDI deposits. Flakes recovered in the 146 and 156 north lines were found generally between 0 and 40 cm below surface.

The bulk of the cultural material recovered from subsurface deposits was found in nine 1 x 1 m test units located along the southern edge of the terrace. All were located above the area where a number of flakes were visible on the eroded slope. One .5 x .5 m unit (136N/186W), excavated west of these units and above slopes where little or no cultural material was visible, was sterile.

Approximately 900 flakes were recovered from test units, as well as 5 cores, 27 shatter fragments, 2 projectile points, and several edge modified flakes. One projectile point, recovered from the LKDI unit, was a large, wide notched specimen. The second point, recovered from PMI deposits, was a large, side-notched type. The first point was manufactured from mudstone, the second from a medium grain quartzite.

Table 11-17. Inventory of Recovered Tools and [illegible] Site 24LN1[illegible]8.

Artifact Type (Morpho/Technological)	Quantity Absolute	Relative
Mudstone Flakes/Chips	[illegible]	67.85
Quartzite Flakes/Chips	[illegible]	23.20
Chert Flakes/Chips	19	0.75
Other, Small Flakes/Chips	2	0.08
Cobble Cores	5	0.20
Decorticated Cores	2	0.08
Bipolar Cores	1	0.04
Biface I and II	5	0.20
Shatter	30	1.18
Biface III	6	0.24
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	1	0.04
Edge Modified Flake/Chip	21	0.82
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	1	0.04
Late Middle Prehistoric Projectile Points	1	0.04
Early Middle Prehistoric Projectile Points	1	0.04
Dart Size Fragments	1	0.04
Early Prehistoric Projectile Points	-	-
Battered Stone	3	0.12
Ground Stone	1	0.04
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	2,546	100.00

In addition to flaked lithic tools and debris, FCR was recovered from the 1 x 1 m test units along the terrace edge. Most of the rock was quartzite, although a small quantity of argillite (i.e., mudstone) and some rocks of unidentified material were recovered. A single piece of FCR was recovered from a .5 x .5 m unit at 176N/166W. Otherwise, FCR was not recovered in test pits located away from the southeast edge of the site.

Unmodified cobbles and fractured, but not fire-cracked, cobbles were found in association with the dense cultural material strata. These cobbles were recovered only from the nine 1 x 1 test units excavated at the southeast terrace edge. Most of the cobbles were large, thick pieces of argillite, although some quartzite cobbles were recovered as well.

One concentration of nine unmodified or fractured cobbles was found in unit 135N/158W, at the edge of the terrace. Seven of the cobbles were argillite and two were of quartzite. One stone was in two parts and the pieces (which fit together) were found about 40 cm apart in the same level. One argillite cobble had been battered along one edge. Several thin, edge modified flakes were also found in direct association with the cobble feature. All the cobbles were found between 5 and 22 cm below surface in a PMI matrix. They did not form a readily discernable pattern. Instead, each cobble was lying at a slightly different elevation, and at dissimilar orientations and angles. However, they were clustered in such a way as to suggest they once were on a single surface. A few pieces of FCR and a large number of unmodified flakes were also found in the excavation units in the PMI deposits between 0 and 30 cm below surface.

Few (12) faunal remains were recovered from 24LN1058. Two rodent bones were obviously intrusive. The remaining bones were considered to be in archaeological context. These include the single identified specimen, Canis. Very little of the bone material was burned. Although a paucity of burned bone fragments is uncharacteristic of sites with faunal remains, a similar situation was noted at 24LN1054.

Medium grain quartzite and fine grain mudstone were the most commonly occurring lithic materials at the site. Coarse grain quartzites, very fine grain mudstone and a small amount of chert also were recovered. Most of the chert was from the surface along the east-central edge of the landform.

Most of the subsurface material was recovered from the LKDI, PMI and AMII sediments. Some cultural material was recovered from AMII/AMI mixed excavation levels, but most of it was confined to the AMII deposits or to the frost features that had intruded into the AMI sediments.

In most of the test units along the terrace edge, the upper boundary of PMI deposits was approximately 10 cm below surface and the lower boundary was difused, gradually changing to a AMII matrix, generally about 30 cm below surface. Cultural material was found

Recovered tools included all categories and classes, except arrow size fragments and grooved/incised stone (Table 11-19). The greatest quantity and variety of arifacts was collected from the LKDI unit. Besides debitage, only two edge modified flakes and a biface came from PMI sediments. Only a limited amount of debitage was recovered from AMI and AMII sediments.

For the artifact collection as a whole, fine grain mudstones and medium grain quartizites were the dominant material types. Most tools were made from the black mudstone. Cherts were represented minimally, primarily by debitage.

Material type preferences were fairly consistent throughout the deposits. Fine grain mudstones, primarily the black material, were dominant in all stratigraphic units. Quartzite, primarily red to yellow in color, was the next most frequent material type all analytic units (i.e., LKDII through AMII).

A total of 83 bones and bone fragments was recovered from 24LN1073. Over half (50.6%) are identifiable to at least family level, however, most of these appear to be intrusive. Three elk bones, a tooth fragment from a large carnivore (i.e., bear), and a single rabbit bone are identified as archaeological remains, as are the remaining 31 bone fragments which have been burned and are indicative of processing and/or use of bone as fuel. An elk antler tool (see Chapter 9 and Figure 9-1, c) was also recovered from the surface of the site (Roll and Bailey 1979).

Interpretation

Projectile points from 24LN1073 are indicative of a considerable time span. Judging from their frequencies most of the occupation probably occurred during the late Middle Period and the earlier part of the Late Prehistoric Period (Table 11-20). However, the early Middle Period is represented by the presence of large "eared," indented base and large, side-notched projectile points. The blade fragment of a large, lanceolate shaped point only hints at an Early Period occupation. Most of the excavated cultural remains recovered from this site came from the PMI sediments tentatively dated between 2,000 and 6,700 B.P. The limited quantity and variety of material collected from the underlying AMI and AMII units may suggest an earlier, but more limited occupation of the site. The presence of cultural material in Pre-Mazama sediments provides some support for the long term occupation, but it does not necessarily mean that the site was occupied more than 6,700 years ago. It means only that occupation may have occurred on the AMII surface, which could have been after erosional events removed overlying PM deposits. However, the considerable disturbance in all excavation units (large, deep tree roots), the limited variety and number of artifacts from below the PMI unit, and the small size of most AMI and AMII artifacts raise some questions about earlier occupation. Artifacts recovered from the AMII and AMI units could be the result of downward migration caused by bioturbation and cryoturbation.

Prior to excavating five 1 x 1 m units and the 16 exploratory probes, bank profiles were prepared (Figure 11-20). This procedure offered an efficient and less destructive means for determining the presence of in situ artifacts or cultural features and for assessing the extent of recent disturbances. The profiled areas ranged between 50 to 100 cm in width and 50 cm in length (i.e., depth below surface). The slump from each cutbank unit was screened, as were the sediments removed to provide a clean profile.

Given the large quantity of artifacts adjacent to the southern cutbank, five 1 x 1 m units were placed in the grass covered area above the cutbank. These units were the vicinity of the two 1981 test pits. Four units were terminated after three sterile levels. Their depths ranged from 90 to 120 cm. The fifth 1 x 1 m unit was placed adjacent to a cutbank profile to facilitate interpretation of the oxidized area observed in the bank profile. This unit was terminated at 20 cm below surface, when it became apparent that the oxidized area was the remains of a burned tree root.

In an attempt to determine site boundaries and to assess the extent of logging and reservoir disturbance, a series of exploratory probes were excavated. These 20 cm diameter posthole units were placed at 10 m intervals along three parallel east-west grid lines. They were dug and screened in 10 cm levels to a depth of 100 cm.

Descriptive Results

Cultural materials recovered during the 1981 surface collection effort were tabulated and plotted on distributional maps. These maps clearly show that the densest cultural materials occurred at the base of what was then the cutbank (Figure 11-21). High density FCR loci were correlated with relatively high flaked lithic tool and debitage densities. Linear artifact distributions along the southern margin of the grid collected area were clearly the result of reservoir erosion. Those oriented east-west indicated reservoir strand lines; and the north-south distributions mark small rills on a steep slope.

The seven FCR features (Figure 11-20) observed during the 1982 season only received surface documentation, as none were in situ. They consisted of 5-30 FCR clustered within areas .5 x 1.5 m or smaller. All observed FCR were quartzite. No other artifacts were associated with the FCR features. Scattered FCR included mudstone and granodiorite specimens but quartzite was the most common.

About 10 flakes, a battered cobble, and a brick fragment were recovered from eight of the exploratory probes. These materials were found primarily in PMI deposits, although the brick and several flakes came from the LKDI unit. Cultural materials were recovered from all seven (including those excavated in 1981) 1 x 1 m units, primarily in LKDI and PMI sediments. Artifacts included over 200 flakes, bifaces, edge modified flakes, a limited amount of FCR and small bone fragments. In addition, flakes were recovered from one cutbank profile in the screened slump.

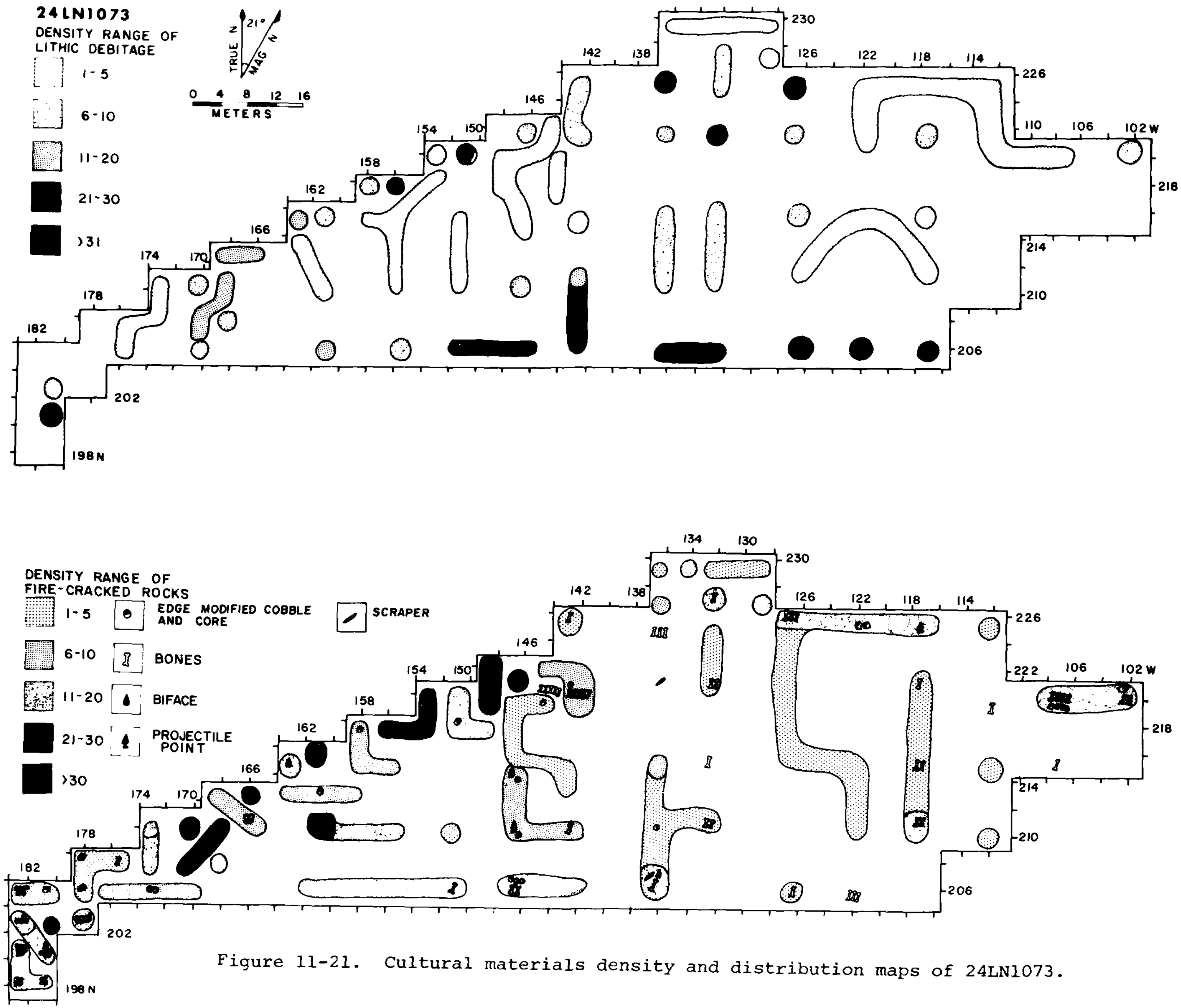


Figure 11-21. Cultural materials density and distribution maps of 24LN1073.

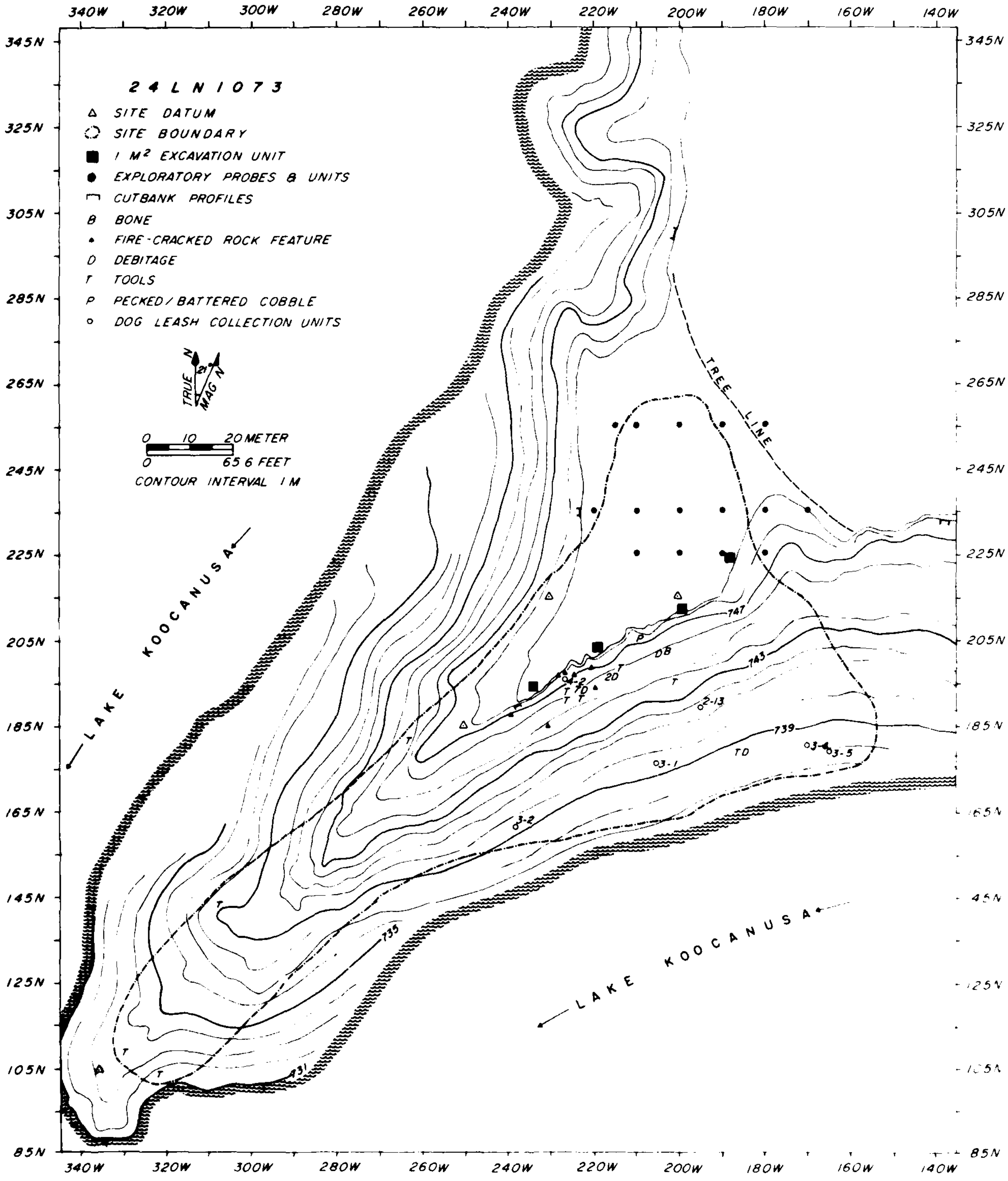


Figure 11-20. Map of 24LN1073, a high diversity site in the McGillivray site cluster.

level removed more than one vertical meter of prereservoir sediments from the site. Available data indicate that at least 5 horizontal meters of the site's southern margin was lost due to reservoir drawdowns in the last several years (Marilyn Bailey 1982:personal communication). In addition, numerous heavy equipment tire tracks were visible on the grass covered terrace.

General Nature of Cultural Materials

Cultural materials are scattered across a 13,000 m^2 area. Dense concentration of flakes, as well as numerous bifaces, projectile points, cores, unifaces, modified flakes, battered and pecked stone, burned bone, and isolated and clustered FCR are documented. The vast majority of the artifacts and all of the FCR features are concentrated along a nearly 10 m wide denuded reservoir strand line adjacent to the southern bank of the terrace (Figures 11-20 and 11-21). Artifacts are not visible in the grass covered portion of the site. Isolated FCR densities range from high to very high along the strand line that parallels the southern bank. However, FCR densities for the rest of the site area vary from very low to low.

Stratigraphy

The upper 10-30 cm of the site are disturbed LKDI sediments. Underlying this unit are 20-40 cm of PMI sediments. PMI sediments overlay 20-60 cm of AMII deposits, which overlay the AMI unit. Considerable bioturbation is apparent in these moderately well sorted sheet sands (see Chapter 7 and Figure 7-10). Although cultural materials come from as deep as 80 or 90 cm below surface, the majority of the artifacts are from the upper 50 cm. The stratigraphic integrity of the infrequent artifacts from AMI and AMII units is suspect due to extensive bioturbation.

Testing Rationale and Methods

During the 1981 field season a 2 x 2 m grid was established over the site and all cultural materials exposed on the surface along the cutbank on the site's southeastern margin were collected. FCR was subsequently weighed and discarded. Artifact proveniences were maintained by 2 x 2 m grid units. This site was collected in 1981 because it was eroding rapidly and large numbers of artifacts were being lost in the process.

For the 1982 season artifacts were marked with color-coded wire flags as part of the reconnaissance of the area. Given the large quantity of surface artifacts collected in 1981, only a few tools were provenienced and collected in 1982. In six cases, 1.15 m dog-leash units were used to collect artifacts in close proximity.

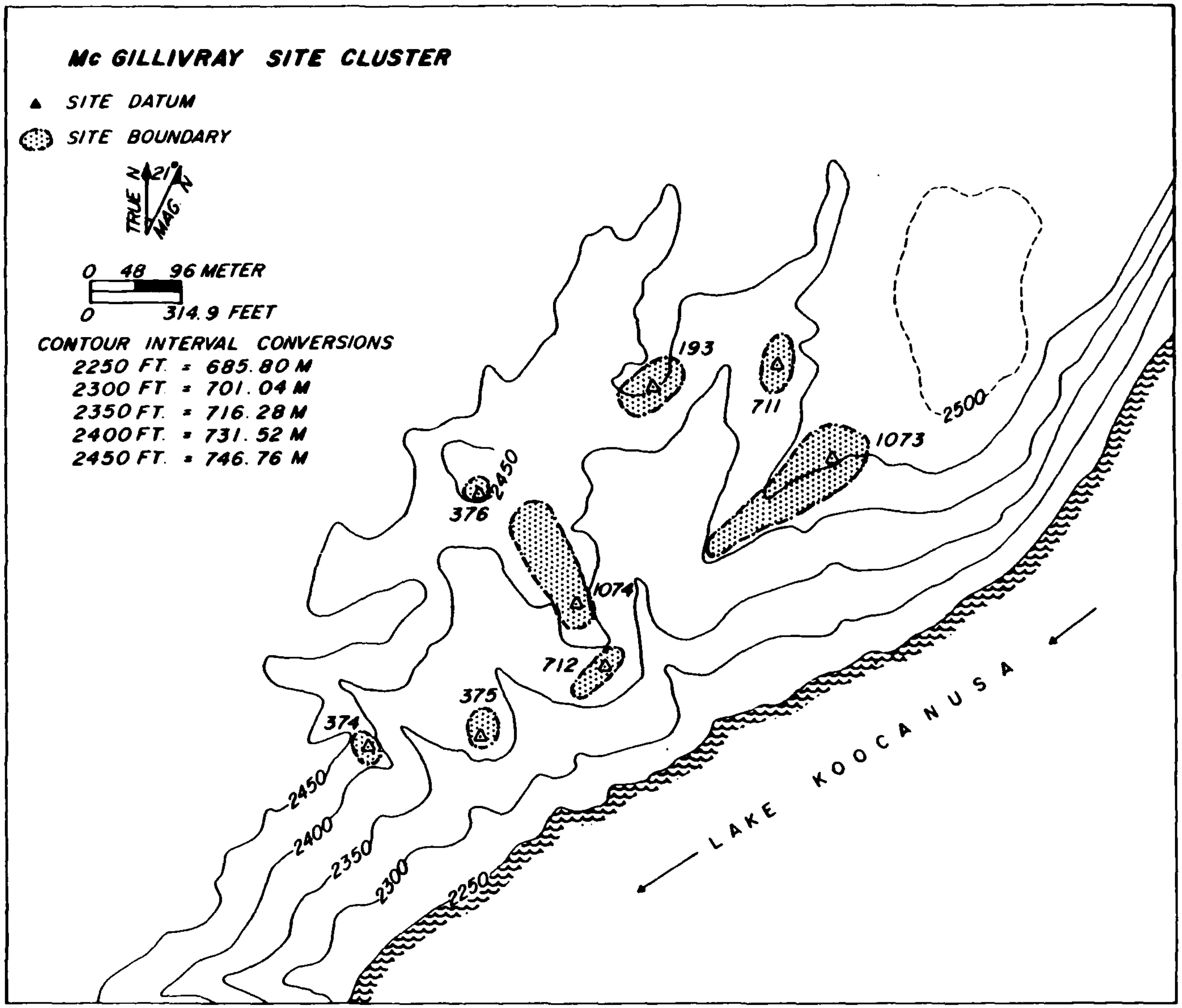


Figure 11-19. Map of the McGillivray Site Cluster showing the location of 24LN1073 and other sites.

probably related to some type of tool manufacturing perhaps wood working or bone working. It is more like an abraider than it is like a mano or hand held grinding stone. The number of cores and flakes suggest that tool manufacturing was an important activity. Interestingly, the site's setting on a fan/debris flow, provides ready access to a variety of lithic raw materials. Most, if not all of the finished tools, such as Biface IIIs, and edge modified flakes are indicators of hunting related activities. Nonflaked lithics that might be indicative of vegetal processing are lacking. The relative paucity of burned bone bits may well be an indication that most processing of game animals took place elsewhere. Based on tool types, light-duty tasks are much better represented than are heavy-duty tasks.

The intermittent tributary probably supplied water during the early spring. This, coupled with the facts that the site has a good solar exposure and FCR is abundant, is considered to be a reasonable indication that the site was occupied during the wet and/or cold seasons, namely winter to early spring.

Site 24LN1073 (Sheila J. Bobalik)

This site is part of the McGillivray Site Cluster, located on the west side of the reservoir at an elevation of 2450-2460 feet (ca. 748 m) amsl. This Lower Canyon zone site is on a southwestern projection of the T8 terrace and has a southern exposure. It is largest of the eight sites in the cluster (Figure 11-19) and the one that yielded the highest frequency of artifacts. Only two of the sites in the cluster--24LN374 and 24LN712--are classified as low density, the others are all high density sites.

The Kootenai River is approximately 80 m below and 470 m south of 24LN1073. It is the nearest permanent water source. An intermittent tributary is located 70 m horizontal and 10 m vertical west of the site. This stream was active in mid-April, but had ceased to flow by late May 1982.

Grass covers the relatively intact northern portion of the projection on which 24LN1073 is located. However, the southern and western margins of this projection have suffered extensively from reservoir fluctuations. Burned tree stumps are scattered across the denuded modern reservoir strand lines. The stumps and the large root impressions observed in the excavation units suggest the area once supported a relatively open coniferous forest.

The site area, like all others in the drawdown zone, was disturbed by logging and other activities related to reservoir impoundment. Reservoir cutbank slumpage is considerable, especially along the southern margin of the terrace projection. In 1982, some of the 1981 grid stakes were visible on slump blocks. One of the two 1981 excavation units was washed out completely by reservoir wave action. The other unit was (in the spring of 1982) only about 10 cm from the existing bank. Between 1981 and 1982, fluctuations in the reservoir

fossilferous chert speciman is more like a scraper than a projectile point; (2) an elongated fragment of a ground stone object made of sandstone and ground or abraded on four sides; and (3) an antler tine (deer) about 23 cm long, with a faceted, slightly polished tip and a large "eye" through the other end (see Chapter 9 and Figure 9-1,e); this artifact resembles several kinds of tools including a thatching tool, an arrow shaft wrench, and a pressure flaker. The site also produced four different projectile points representing all broad time periods, except for the historic.

Very few faunal remains were recovered. Other than the antler tine tool, only seven small bone fragments were collected. Three of those were burned and none could be identified to the family or species level.

Interpretations

Most of the cultural materials occur as lag deposits that were once part of an overlying matrix. Depending upon the specific location within the site, the amount of sediment loss due to reservoir caused erosion varies from only a few centimeters to as much as 80 cm. Most erosion of the site's sloping surface appears to be in the form of cutbank slumping or calving. While the reservoir is being filled (and presumably during drawdowns), blocks of sediments, approximately 40 cm deep by 10 to 100 cm wide and as much as 200 cm long, are lost on a daily basis along the margin of the site. It is that type of erosion which probably accounts for the lack of discrete FCR features at 24LN364. It also is possible that such intensive and extensive erosion may have removed faunal material. Bone fragments are low in bulk density and could have "floated" away from the site. However, this is not a likely probability because other sites within the drawdown zone and on sloping sufaces yielded considerable quantities of faunal materials.

The presence of four very different kinds of projectile points provides little indication of which time period is represented best. All four specimens are from either the surface or disturbed, subsurface sediments. However, considering that faunal preservation is generally poor in the area, the presence of the well preserved antler tine tool suggests that at least some occupation occurred within the later time periods. Furthermore, the fact that several of the tools, including the small and large corner-notched and barbed projectile points, are made from the brown opaque mudstone material also is an indication that much of the occupation occurred during the Late Middle and Late Prehistoric periods. The presence of the large "eared," indented base and the large, lanceolate shaped projectile points may be evidence that the site was occupied during earlier periods, but their presence could also be viewed as a result of aboriginal "relic collecting" activities.

Because there is considerable diversity in the range of tool types at the site, it seems reasonable to suggest that at some point in time 24LN366 functioned as a residential camp for a relatively small group of people, perhaps one or two families. The ground sandstone artifact is

Table 11-18. Inventory of Recovered Tools and Byproducts from Site 24LN364.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	221	60.38
Quartzite Flakes/Chips	54	14.75
Chert Flakes/Chips	53	14.48
Other, Small Flakes/Chips	-	-
Cobble Cores	1	0.27
Decorticated Cores	2	0.55
Bipolar Cores	-	-
Biface I and II	4	1.10
Shatter	8	2.19
Biface III	4	1.10
Biface IV	-	-
Miscellaneous Hafted/Indeterminate Biface	-	-
Uniface	1	0.27
Edge Modified Flake/Chip	11	3.01
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	1	0.27
Late Middle Prehistoric Projectile Points	2	0.55
Early Middle Prehistoric Projectile Points	1	0.27
Dart Size Fragments	-	-
Early Prehistoric Projectile Points	1	0.27
Battered Stone	1	0.27
Ground Stone	1	0.27
Grooved/Incised Stone	-	-
Pecked Stone	-	-
Notched Pebbles	-	-
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	366	100.00

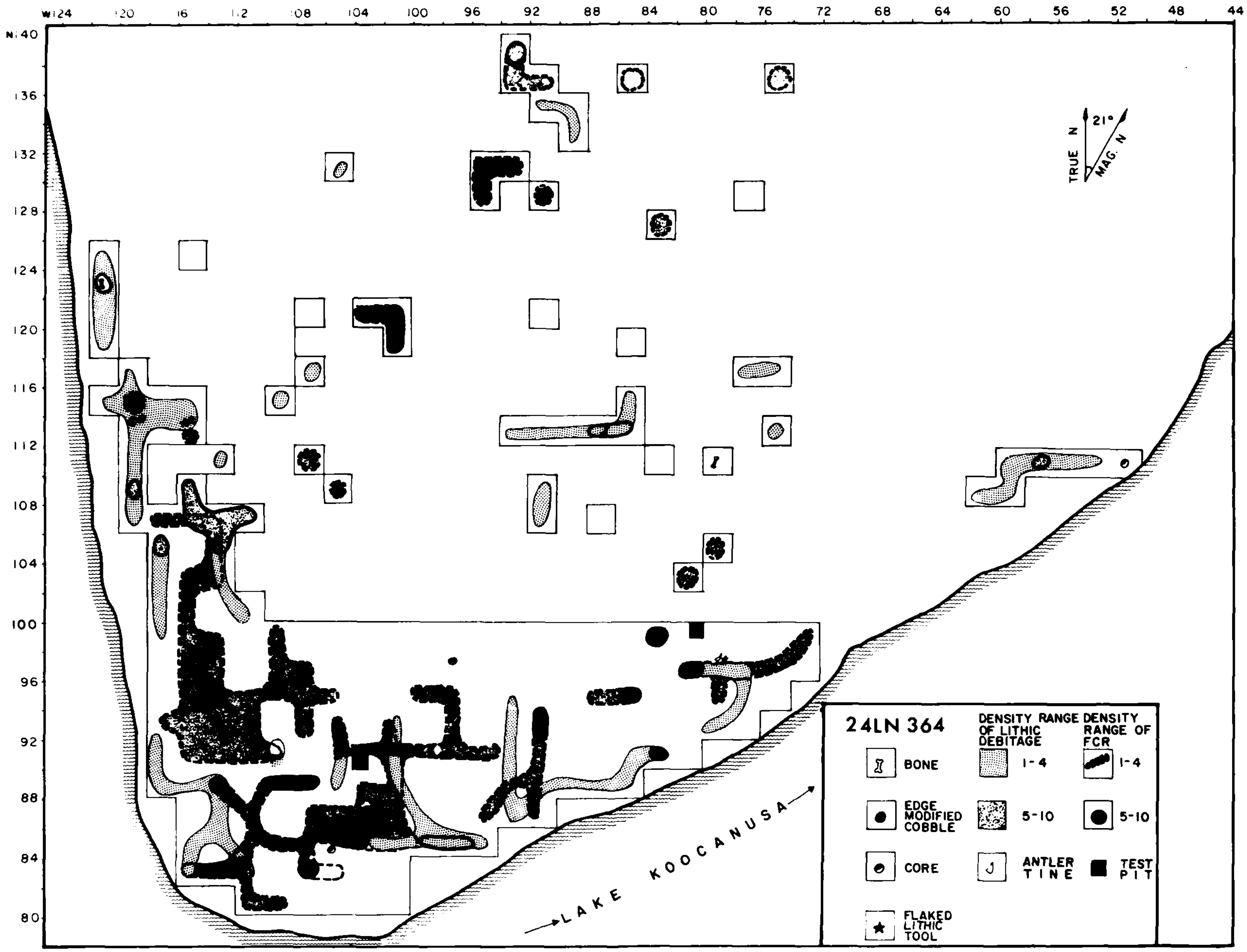


Figure 11-18. Cultural materials density and distribution map of 24LN364.

the end of the landform (Figure 11-18). Although the density of scattered FCR is high, there is only one readily apparent FCR feature. The density of scattered flaked lithics including mudstone, quartzite, and chert flakes is as high or higher than FCR. A wide variety of flaked and nonflaked lithic tools as well as cores occur at the site. Bone fragments are uncommon, but one antler tool is included in the collection.

Stratigraphy

Tree stumps reveal that as much as 60-80 cm of sediment has eroded from the surface as a result of reservoir drawdowns. Site sediments tend to be a sandy loam with varying amounts of gravel. Test pit and cutbank profiles illustrate that the upper 20 to 30 cm of deposits are LKDII and/or LKDI sediments. Depending upon the setting and the amount of erosion that has occurred, the LKDI sediments include and overlie PMI, or AMII, or AMI deposits. However, in most places PMI deposits have been eroded. The vast majority of cultural material is confined to surface. Only one of the test pits produced cultural material, and even then it was confined to the LKDI sediments.

Testing Rationale and Methods

This site was gridded, surface collected and test excavated during the 1981 field season. It was selected for comparative purposes as one of the Lower Canyon zone sites that yielded substantial quantities of lithic artifacts other than FCR. The entire site was collected by 2 x 2 m grid units. Fire-cracked rock was counted, weighed, and discarded at an off-site location; all other cultural materials were collected. Test pit locations were judgmentally selected to represent the presumed stratigraphic variability and to be in proximity to artifact scatters of different kinds and densities. Test pits were dug to a depth of 60 cm below surface.

Descriptive Results

As noted, most of the cultural material was recovered from the surface, but the upper 20 cm (LKDI) of one test pit yielded a notched uniface (unique in the entire sample), the tip of a Biface III and several flakes. Even though the density of scattered FCR was high, only one FCR feature was recorded, near the middle of the site where there was less erosion.

A wide range of lithic raw materials, including fossiliferous chert, was found at the site, but as with most other sites, locally available mudstone materials were most common. This site produced a wider range of tool types than did most other sites of similar size (Table 11-18). Included are three rather unusual artifacts: (1) a relatively thick, side-notched uniface, shaped like a small, corner to side-notched projectile point; the overall morphology of this

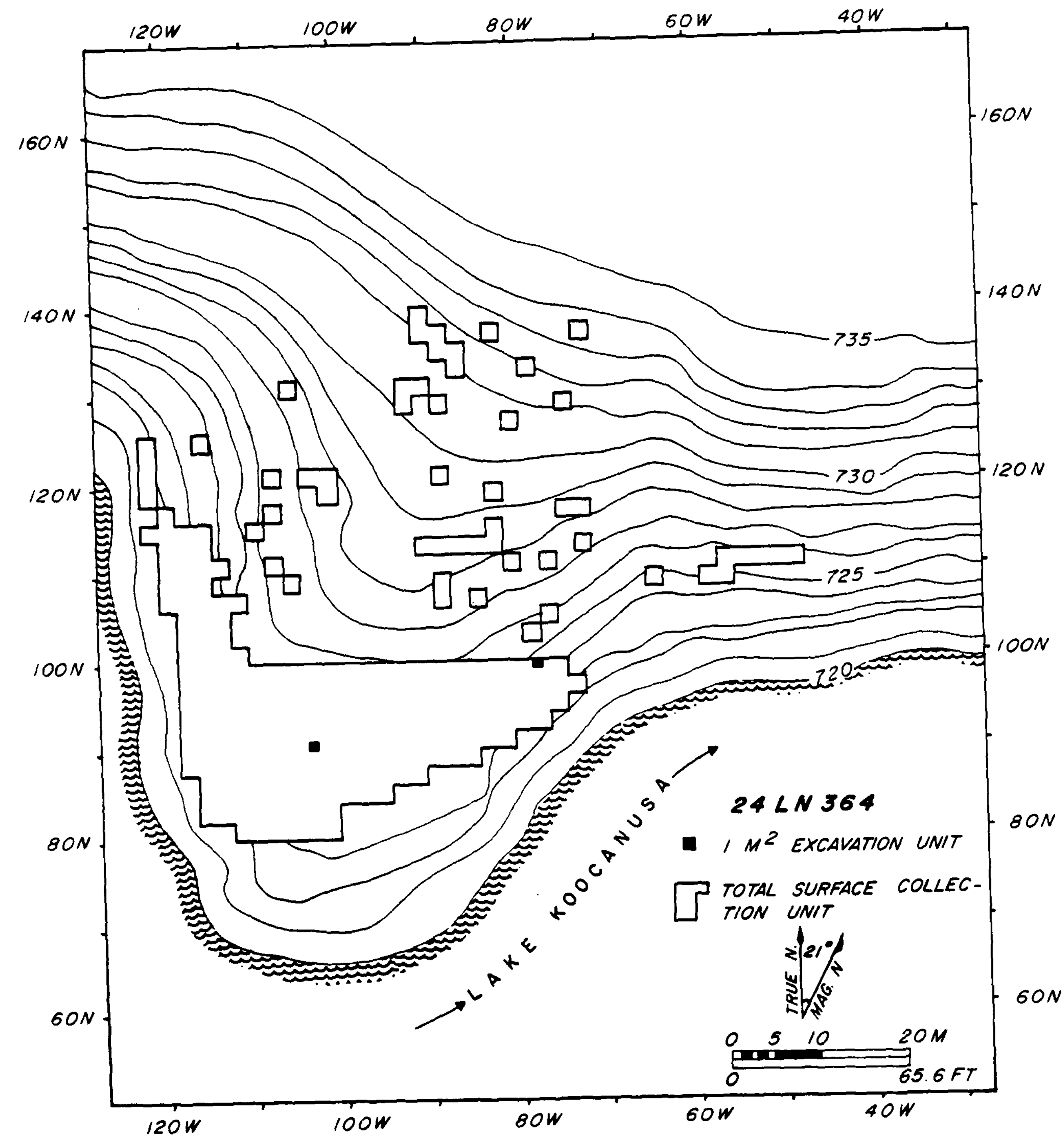


Figure 11-17. Map of 24LN364, a high diversity site near the mouth of Warland Creek.

proportionately more common at 24LN1058 than at 24LN1054. Edge-ground cobbles, pestles, and mauls were not recovered. The bulk of the tools are suggestive of hunting related activites. Limited quantities of faunal remains provide evidence of processing game animals. The presence of numerous cores, flaked lithic debitage, and broken tools indicates all stages of lithic reduction are represented. The notched pebble artifact is quite large in size and relatively thin; it has only one notch and it exhibits considerable use-wear. The function of this specimen remains unclear but it is not typical of the "net weights" recovered from other sites.

The partially excavated cobble feature appears to be associated with the kinds of tools expected to be related to meat and/or hide processing. These include several thin edge modified flakes (side and end scraper-like), as well as projectile point fragments and thin bifaces. Seen from this perspective the unaltered rocks could have been used for a number of purposes including securing hides while they were being defleshed or dehaired, as working surfaces for softening hides, or simply as some kind of small table. More detailed analysis of the spatial distribution of flaked lithic and other artifacts in and around the whole feature are needed before reaching conclusions concerning the function of the cobble feature. Furthermore, additional excavation, coupled with more complete analysis of existing information, could well reveal that the cobble feature represents the remains of some kind of structure and has little or nothing to do with hide/meat processing.

Given the wide range of artifact types, the fact that fire-cracked rock is abundant, the site's proximity to permanent water, and its southeastern solar exposure, occupation could have, and likely did, occur at several seasons of the year. The wide range of artifact types, some of which are representative of different time periods, suggests that 24LN1058 functioned intermittently as a residential site, primarily during the late Middle Period.

Site 24LN364

This site, also known as the Warland Site, is located in the Lower Canyon zone near the mouth of Warland Creek. It lies on a sloping, peninsula-like remnant of a fan/debris flow that is graded to T5 (Figure 11-17). Warland Creek, a permanent stream, lies about 190 m south and 18 m below the site. An intermittent stream is located approximately 40 m north and 6 m below 24LN364. The site has a southwestern solar exposure and is situated at 2370 (722 m) amsl, approximately 70 m above the Kootenai River. Tree stumps indicate the area supported a moderately dense coniferous forest. The slopes and terraces above and north of the site may have been more open.

General Nature of Cultural Materials

Aboriginal cultural materials are scattered over an area of approximately 2,500 m^2, with the most dense concentrations being near

throughout PMI and AMII deposits. The densest cultural deposits generally occurred between 30 and 40 cm below surface in the AMII unit.

The same general range of cultural materials--flakes, shatter, modified flakes, etc.--are found in both the PMI and AMII units and in basically the same proportions. Flakes/chips is the largest category in both, followed by shatter and then flaked lithic tools. The same material types are present as well. However, there is some change between strata in the proportions of materials . Coarse grain quartzites were more common in the PMI deposits than they were in the AMII deposits where medium grain quartzites dominated the quartzites. A second difference between PMI and AMII material types is in the proportion of quartzite to mudstone. In the PMI stratum, 119 quartzite artifacts were recovered as compared to 188 mudstone artifacts. Quartzite was less common porportionately in the AMII deposits where 125 quartzite and 352 mudstone items were found. The unmodified cobbles (i.e., furniture rock) tended to be restricted to the PMI sediments. In one unit, four were found predominantly in the PMI, with one being in the upper 10 cm of the AMII deposit.

Interpretations

Site 24LN1058 yielded the second highest frequency of artifacts recovered during the 1981-1982 field seasons. A wide range of artifact types was recovered, but not to the extent as for 24LN1054. The earliest occupations at 24LN1058 appear to be somewhat later than those at 24LN1054. This is suggested by the absence of large, lanceolate shaped points and because only one of the three relatively complete projectile points--a large, side-notched specimen--is considered indicative of the early Middle Period. The small, side-notched specimen (see Figure 8-10,d), is reminiscent of the Avonlea type (i.e., Type 3 in the LAURD system) commonly found at sites adjacent to the Kootenai River (Roll 1982). However, it may not be an arrow point; this is suggested because of its exceptionally wide (12.2 mm when the mean for points in that subclass is 8.6 mm) minimum tang or neck width, which is indicative of a dart point. The large, wide-notched specimen is considered to be a dart point like those characteristic of the late Middle Period. Also indicative of the comparatively younger age 24LN1058 is the fact that 37.6 percent (311 artifacts) of the cultural materials from relatively unmixed analytical units were recovered from the PMI unit, while 58.0 percent (480 artifacts) came from the AMII unit and only 4.4 percent (36 artifacts) is from the AMI unit. It should be remembered that cryoturbation may well have moved artifacts in the AMII unit into the AMI unit. For site 24LN1054, only 12.1 percent of the artifacts came from the PMI unit, while 76.5 percent came from AMII deposits, and 11.4 percent from AMI deposits. Collectively, the information available for 24LN1058 indicates that it is primarily a late Middle Period site, but that early Middle Period and probably Late Prehistoric Period occupations also occurred there.

Site 24LN1058 yielded a wide range of artifact types suggestive of both heavy-duty and light-duty tasks. Thick, edge modified tools are

Table 11-19. Inventory of Recovered Tools and Byproducts from Site 24LN1073.

Artifact Type (Morpho/Technological)	Quantity	
	Absolute	Relative
Mudstone Flakes/Chips	928	62.12
Quartzite Flakes/Chips	291	19.48
Chert Flakes/Chips	51	3.41
Other, Small Flakes/Chips	9	0.60
Cobble Cores	14	0.94
Decorticated Cores	5	0.33
Bipolar Cores	1	0.07
Biface I and II	13	0.87
Shatter	79	5.29
Biface III	11	0.74
Biface IV	7	0.47
Miscellaneous Hafted/Indeterminate Biface	2	0.13
Uniface	6	0.40
Edge Modified Flake/Chip	47	3.14
Arrow Size Fragments	-	-
Late Prehistoric Projectile Points	7	0.47
Late Middle Prehistoric Projectile Points	7	0.47
Early Middle Prehistoric Projectile Points	4	0.27
Dart Size Fragments	2	0.13
Early Prehistoric Projectile Points	1	0.07
Battered Stone	5	0.33
Ground Stone	1	0.07
Grooved/Incised Stone	-	-
Pecked Stone	1	0.07
Notched Pebbles	2	0.13
Miscellaneous	-	-
TOTAL QUANTITY RECOVERED	1,494	100.00

Table 11-20. Inventory of Time Period Markers for Site 24LN1073.

Time Period/Classes	Quantity	
	Absolute	Relative
Historic Aboriginal	--	--
Late Prehistoric Period		
Small, Side-Notched Points (Figure 8-10, a-f)	--	--
Small, Corner-Notched Concave Base Points (Figure 8-10, l-p)	4	19.1
Small, Corner to Side-Notched Points (Figure 8-10, q-t)	2	9.5
Small, Corner-Notched and Barbed Points (Figure 8-10, g-k)	1	4.8
Small, Arrow Size Point Fragments	--	--
Subtotal	7	33.4
Late Middle Prehistoric Period		
Large, Short Stemmed Points (Figure 8-12, a-b)	1	4.8
Medium, Corner to Side-Notched Points (Figure 8-11, g-l)	3	14.3
Large, Stemmed, Straight Base Points (Figure 8-11, m-o)	--	--
Large, Wide Notched Points (Figure 8-11, p-s)	--	--
Large, Corner-Notched and Barbed Points (Figure 8-12, i-j)	1	4.8
Medium, Stemmed, Concave Base Points (Figure 8-11, a-f)	2	9.5
Large, Indented Base Points (Figure 8-12, k-m)	--	--
Subtotal	7	33.4
Early Middle Prehistoric Period		
Large, "Eared," Indented Base Points (Figure 8-13, a-j)	2	9.5
Large, Side-Notched Points (Figure 8-14, f-l)	2	9.5
Subtotal	4	19.0
Generalized Pre-Late Prehistoric		
Medium and Large Dart Size Point Fragments	2	9.5
Early Prehistoric Period		
Large, Lanceolate Shaped Points (Figure 8-14, a-e)	1	4.8
Large, Stemmed, Concave Base Points (Figure 8-13, k-o)	--	--
Subtotal	1	4.8
TOTAL TIME PERIOD MARKERS	21	100.0

Artifactual and sedimentary data indicate that this site was occupied primarily during and after the late Middle Prehistoric Period. The large number of artifacts could be the result of a few longer term (weeks) occupations or a number of shorter term (days) occupations. However, viewed from the perspective of the land use model, it is most likely that 24LN1073 represents a series of short-term residential camps. It is unlikely that resources in the immediate vicinity of the site would be available in sufficient quantity to support very many people for very many weeks.

It appears that the entire lithic reduction sequence (based on the quantity of cores, shatter, and bifaces) is represented at this site. This is the case for local lithic resources such as mudstone and quartzite. However, the kinds of artifacts (e.g., small flakes and tools) made from nonlocal materials (i.e., cherts) argue that primarily refurbishing and/or the latter stages of reduction are represented for these rare materials.

Hunting as an activity also is well represented by 21 projectile points and fragments, and Biface IIIs and IVs, as well as by the burned bone. The unusual number of unifaces, some of which are large may be indicative of wood working activities. Two notched pebbles (i.e., "net weights") also were recovered. The presence of "net weights" at a site far from permanent water might suggest that some individuals who occupied the site were involved in fishing activities elsewhere, but curated these items at 24LN1073. Consideration also should be given to the possibility that "net weights" may be related to activities other than fishing, perhaps the use of nets or snares in hunting land animals.

The site exposure and the considerable distance to a permanent water source suggest a late winter to early spring occupation, when a nearby intermittent tributary would have been flowing. The quantity of material at this site indeed indicates considerable utilization of the locality and locally available water seems essential.

Discussion

This discussion focuses on the distribution of site types and to some extent the distribution of site clusters. Attention is also given to an assessment of the observed site location patterns in relation to the predicted patterns. Some of the data used here are drawn from Chapter 6 which contains general information related to site locations. The ideas presented here, as well as those in the interpretation sections of the preceding site descriptions constitute a continuation of the effort to refine the project's research design and develop more precise models of land use patterns. These ideas are viewed best as preliminary hypotheses or subsequent approximations related to conceptual models that can and should be tested and refined again. A review of some of the concepts presented earlier in the report initiates this discussion.

In the research design (Chapter 4), it is argued that for most of the period of human utilization the middle Kootenai River valley was occupied, primarily during the winter, by small groups of highly mobile hunters. Winter occupation is expected because during that season game animals are concentrated in the valleys where snow accumulation is less and forage is more abundant than in the adjacent uplands. Game animals, and probably people, dispersed into the uplands during the late spring and early summer as forage became more abundant in comparison to the valleys. General hunter-gatherer data indicate that groups living in coniferous forests, where aquatic resources are not abundant, tend to subsist mainly on meat. Family groups tend to make frequent residential moves on the order of once a week to every other week (Kelly 1983). Although game animals provide the bulk of the diet in environments like the project area, vegetal foods of some kind and perhaps fish or other aquatic resources probably are necessary to provide adequate nutrition. Vegetal resources, even in low quantities provide carbohydrates which efficiently yield energy in conjunction with a predominanely meat diet (Speth and Spielman 1983).

Under conditions of high residential mobility and a hunting based subsistence, a high density of sites is expected. In general, sites should exhibit similar tool assemblages, but overall a wide range of variability would be expected depending upon the number of times specific locations were occupied. To some extent this variability also would depend on the amount of logistical mobility, but this form of mobility would be much more limited than among more sedentary hunter-gatherers. Special purpose sites, as represented by assemblages dominated by vegetal processing tools or fishing tools, or game animal kill/butchering tools should not be common because the groups would tend to move to the resources and conduct most subsistence related tasks at their residential camps (Binford 1980). Base camps or other kinds of semisedentary residential villages occupied for prolonged periods of time and represented by substantial midden-like accumulations would be rare to absent.

Data generated as a result of the analyses of site types and their locations support many of the ideas presented in the research design. Use of the valley, primarily during the winter is indicated by at least two different measures. First, almost half (45.4%) of all the sites in the area have good solar exposures and only 13.2 percent have poor solar exposures. The other sites have moderate--west, northwest, east, or southeast--solar exposures. This indicates that prolonged daily solar exposure was an important criterion in selecting a campsite location. Good solar exposures probably are more advantageous during the cold and wet winter and early spring than during the comparatively hot and dry summer and early fall. Distance to permanent water sources is a second general way to measure seasonality. Sites near permanent water could be occupied at any time of the year. In general, however, it is likely that sites situated far from permanent water were either occupied for very brief periods of time or they were occupied when water was available from a nearby intermittent water source. During the cold, wet winters and early springs in the project area today, water is available widely from intermittent streams that flow with snow-melt water. The

fact that only 17.3 percent of all the 249 sites are within 99 m of a permanent water source supports the contention that winter occupation was predominant in the project area. That idea is given even more support by the fact that over half (57.4%) of the sites are located more than 300 m from a permanent water source. The remainder of the sites (63 or 25.3%) are found at moderate distances (i.e., 100 to 299 m) from permanent water sources. Although distinctions between permanent and intermittent water sources are based on contemporary conditions, there seems to be little reason to believe that most water courses draining steep valley walls and having small catchment areas were permanent ones, even under considerably cooler and wetter climatic conditions.

The pattern of a high percentage of sites being situated far from permanent water holds for both high and low diversity sites, but there are some differences. Of the 34 high diversity sites, 44.1 percent (15) are located far (i.e., more than 300 m) from permanent water, 29.4 percent (10) are at a moderate (i.e., 100 to 300 m) distance and 26.5 percent (9) are near (i.e., less than 100 m) permanent water. For the 129 low diversity sites, 65.9 percent are far from permanent water, 20.2 percent are at a moderate distance, and only 13.9 percent are near permanent water. Very similar patterns hold for the group of 32 more ephemeral sites--debitage only (4), FCR and bone (16), and FCR only (12)--and for the 37 different isolated artifact locations. Fewer than 20 percent are located near permanent water and more than 50 percent are found far from permanent water. From these data it is clear that all aboriginal site types share a common distributional pattern with regard to distance from permanent water, but a greater proportion of high diversity sites are near permanent water.

There are other locational similarities among the various site types. An apparent one is the distribution of sites according to terrace setting but here too there are some differences. High and low diversity sites are distributed in a very similar fashion. For example, 41.2 percent of the high diversity sites as compared to 49.6 percent of the low diversity sites are on the middle terraces (i.e., T5 and T6), while 29.4 percent of the high diversity sites and 24.0 percent of the low diversity sites are on high terraces (e.g., T7 and higher), and 29.4 percent of the high diversity as compared to 26.4 percent of the low diversity sites are on low terraces (i.e., T1 through T4). Interestingly, 54.1 percent of the isolated artifact locations are on high terraces while only 12.5 percent of the ephemeral sites are so located. Furthermore 46.9 percent of the ephemeral sites are on low terraces as opposed to only 19.9 percent of the isolated artifact locations. Thus, the high and low diversity sites exhibit similar vertical distributional patterns but ephemeral sites and isolated artifact locations are distributed quite differently. The highest percentage of high and low diversity sites are on the middle terraces, while most isolated finds are on the high terraces and most ephemeral sites are on the low terraces. These differences largely remain unexplored, but they may be related to the fact that sites on and near the valley bottom and in proximity to the Kootenai River tend to be younger than sites on higher and middle terraces.

As noted in previous subsections, there are important differences regarding the distribution of site types in the Lower Canyon and Tobacco Plains zones, but data presented in the preceding paragraphs indicate that high and low diversity sites are similar in several other respects. Before addressing the differences in horizontal distribution within the project area, it is useful to compare tool assemblages between high diversity and low diversity sites. These comparisons are restricted to sites with artifact samples considered to be relatively representative of the sites' contents (see Appendix B). Table 11-21 compares individual high diversity sites, as well as the combined high diversity sites and the combined low diversity sites. It is necessary to combine the samples from the low diversity sites to yield artifact frequencies that are comparable to those from individual high diversity sites. Combining the high diversity sites provides a set of average figures that can be compared with the combined figures for low diversity sites. Comparing and contrasting the artifact assemblages from high and low diversity sites is one way to better understand the relationship between these site types.

High diversity sites differ among themselves in several respects, but the more obvious differences are in the relative proportions of tools considered to represent heavy-duty tasks. When the tools and cores from the 39 low diversity sites are combined, it becomes apparent that a wide range of artifact types are represented and they occur in relative frequencies that do not differ greatly from the combined high diversity sites. It would follow then, that similar kinds of activities are represented at least at some of the high and low diversity sites. These similarities are interpreted as a strong indication that high diversity sites are a product of repeated occupation of the same location by small groups of mobile hunters. Low diversity sites are the result of fewer occupations of any given location on the landscape, but the kinds of activities carried out there could be identical to those carried out at high diversity sites. Seen from this perspective, high diversity sites would attest to intensive utilization of presumably more abundant resources in a particular area. Low diversity sites would be indicative of less intensive, perhaps more extensive use of presumably less abundant resources in a given area. It also could be argued that the ephemeral sites and isolated artifact locations represent even less frequent utilization of a particular area, but those kind of sites also would be the expected result of activities like "overnight camping" en route to another short-term residential camp. It follows from the models generated that a range of site types from isolated artifacts, to ephemeral sites, to low diversity sites, to high diversity sites, would be expected in a montane coniferous forest ecosystem.

Considering high diversity sites to be indicative of repeatedly occupied residential camps and areas where resources are comparatively abundant also allows for a plausible explanation of the differential horizontal distribution of high and low diversity sites. Most (52.9%) of the high diversity sites are found in the Lower Canyon zone which contains only 27.9 percent of the low diversity sites. In contrast, most (58.1%) of the low diversity sites are in the Tobacco Plains zone where only 26.5 percent of the high diversity sites are located. The

Table 11-21. Frequencies of Morpho/Functional Artifact Types for High and Low Diversity Sites with Samples at Least at the Sixth Level of Representativeness.

Site No. 24LN....	Flake Shatter	Cores		Thick Biface		Thick Edge		Nonflake*		Thin Biface		Dart Point		Arrow Point		Thin Edge		Total Number (exclusive of flake/shatter)
	Number	N/Row	%	N/Row	%	N/Row	%	N/Row	%	N/Row	%	N/Row	%	N/Row	%	N/Row	%	
Individual High Diversity Sites																		
193	0	3	18.8	1	6.2	3	18.8	0	0.0	3	18.8	1	6.2	0	0.0	5	31.2	16
364	336	4	13.8	3	10.3	2	6.9	2	6.9	4	13.8	3	10.3	1	3.5	10	34.5	29
365	364	4	17.4	1	4.3	0	0.0	9	39.1	1	4.4	2	8.7	2	8.7	4	17.4	23
366	328	0	0.0	1	6.2	2	12.5	0	0.0	2	12.5	1	6.3	1	6.3	9	56.2	16
375	24	0	0.0	0	0.0	0	0.0	1	20.0	2	40.0	1	20.0	0	0.0	1	20.0	5
376	7	0	0.0	1	25.0	1	25.0	1	25.0	0	0.0	1	25.0	0	0.0	0	0.0	4
385	336	4	22.2	0	0.0	3	16.7	3	16.7	2	11.1	1	5.5	0	0.0	5	27.8	18
386	83	2	14.3	0	0.0	1	7.1	4	28.6	2	14.3	2	14.3	1	7.1	2	14.3	14
387	12	5	20.8	1	4.2	3	12.5	2	8.3	3	12.5	1	4.2	0	0.0	9	37.5	24
388	324	17	25.8	2	3.0	13	19.7	5	7.6	7	10.6	9	13.6	0	0.0	13	19.7	66
394	56	2	18.2	2	18.2	0	0.0	1	9.1	3	27.2	2	18.2	0	0.0	1	9.1	11
396	62	0	0.0	0	0.0	0	0.0	4	57.1	1	14.3	1	14.3	0	0.0	1	14.3	7
417	227	0	0.0	0	0.0	0	0.0	2	25.0	1	12.5	0	0.0	4	50.0	1	12.5	8
423	84	1	14.3	1	14.3	1	14.3	1	14.3	1	14.3	1	14.3	0	0.0	1	14.2	7
443	151	0	0.0	0	0.0	0	0.0	0	0.0	3	37.5	1	12.5	1	12.5	3	37.5	8
656	311	3	12.5	2	8.3	3	12.5	6	25.0	3	12.5	1	4.2	1	4.2	5	20.8	24
706	35	0	0.0	0	0.0	0	0.0	4	36.3	0	0.0	3	27.3	2	18.2	2	18.2	11
711	19	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	2	28.6	1	14.3	3	42.8	7
1054	18,235	64	10.4	30	4.9	71	11.5	52	8.5	107	17.4	48	7.8	12	1.9	231	37.6	615
1055	120	2	8.0	3	12.0	3	12.0	6	24.0	6	24.0	2	8.0	0	0.0	3	12.0	25
1056	5	0	0.0	0	0.0	1	14.3	1	14.3	1	14.3	0	0.0	1	14.3	3	42.8	7
1058	2,496	7	14.9	3	6.4	5	10.6	4	8.5	6	12.8	3	6.4	1	2.1	18	38.3	47
1059	176	7	21.9	2	6.2	3	9.4	2	6.2	8	25.0	2	6.3	1	3.1	7	21.9	32
1060	384	5	12.5	1	2.5	5	12.5	4	10.0	5	12.5	4	10.0	0	0.0	16	40.0	40
1073	1,358	25	18.5	7	5.2	12	8.9	9	6.7	20	14.8	14	10.4	7	5.2	41	30.3	135
1074	308	4	11.4	1	2.9	0	0.0	1	2.9	3	8.6	8	22.9	3	8.6	15	42.8	35
1076	48	0	0.0	0	0.0	3	42.9	1	14.3	2	28.6	0	0.0	0	0.0	1	14.3	7
Combined High Diversity Sites																		
For 27 Sites	25,389	159	12.8	62	5.0	135	10.9	125	10.1	197	15.9	114	9.2	39	3.1	410	33.0	1,241
Combined Low Diversity Sites																		
For 39 Sites	4,740	12	8.3	10	6.9	8	5.6	16	11.1	15	10.4	22	15.3	2	1.4	59	41.0	144

*Includes net weights

point has already been made that winter occupation characterizes the project area as a whole and that probably is due to the "yarding" of game animals. It would seem logical then to expect more intensive utilization of areas where yarding was more common. Because the Tobacco Plains zone is a wide-open area compared to the Lower Canyon zone, there is likely to be less yarding and consequently less of a reason to utilize the area intensively. Relatively few high diversity sites would be expected in the Tobacco Plains zone, even though it has much more foraging space (i.e., areas below 3,000 feet amsl) for game animals. Low diversity sites are the kinds that would be expected in areas like the Tobacco Plains where diverse game resources are available, but not in concentrations. Thus, the Tobacco Plains zone could be characterized as one that was used extensively as opposed to intensively. However, it might well receive more intensive utilization through time in response to increasing human population that would bring about a decrease in game animal populations and consequently a shift in subsistence strategies. As discussed, there is good evidence that the Tobacco Plains area was occupied more intensively by Native Americans during the historic period. Given that the Upper Kutenai were an equestrian group, intensive occupation of the Tobacco Plains zone as opposed to one of the Canyon zones would be expected. This is because the Tobacco Plains is exceptional within the project area in its potential to support horses due to extensive areas of grassland.

The distribution and nature of site clusters conform to the overall patterns discussed here. An inspection of the distribution (Figure 6-1) of named site clusters and unnamed but clustered groups of sites, reveals that they occur throughout the project area. However, site clusters with numerous high diversity sites are confined to the Upper and Lower Canyon zones, except for one cluster located at the mouth of the Tobacco River in the Tobacco Plains zone. Clusters of sites in the Kootenai Flats area of the Tobacco Plains Zone contain very few high diversity sites. Many site clusters in the two canyon zones occur at the mouths of permanent streams (e.g., Bristow and Ten Mile Creek), but there are numerous exceptions. These include the Stuck Truck Site Cluster, the McGillivray Site Cluster, the unnamed cluster of sites near Allen Gulch (of which 24LN388 is a member), and the cluster of sites between Parsnip and Big creeks, which includes 24LN656. Location at the mouths of permanent streams does not seem to be the primary characteristic of site clusters in general. Rather, they seem to be at locations with good solar exposures and in proximity to good foraging areas, including large south facing slopes, expansive terraces, and low relief areas like the Tobacco Plains.

CHAPTER 12

PREHISTORIC LAND USE IN THE MIDDLE KOOTENAI VALLEY

by
Alston V. Thoms and Randall F. Schalk

This chapter summarizes prehistoric land use in the study area as it presently is understood. The first section discusses prehistoric chronology based primarily on projectile point styles and the resulting data are used to detect shifts in land use patterns and relate them to the hypothesized patterns discussed elsewhere in the text. Some of the more obvious differences between ethnographically and archaeologically documented land use patterns are discussed in the last section.

Detecting Chronological Changes in Land Use Patterns

A tentative framework was developed at the outset of this project as a means of generating expectations and explanations for long-term changes in land use (Schalk 1981a). Subsequently, the model was augmented with preliminary results of the first year's fieldwork (Schalk 1981b, 1982) and less so with initial findings during the second year's fieldwork (Schalk and Thoms 1982). Briefly, the model predicted the following changes through time: (1) decreasing home ranges, (2) increasing reliance on residential camps as hubs of operations, (3) increasing group sizes, (4) increasing diversification in the types of food resources exploited, and (5) slight increases in population densities. It was argued that these changes in land use patterns represent regional response to long-term, worldwide, evolutionary trends. These and other changes, particularly the controlled use of forest burning to increase resource productivity, are viewed as trends toward more intensive land use systems.

The early prehistoric pattern is expected to be similar to "foragers" operating in a largely undifferentiated area, wherein residential mobility is high, and there are but few functionally or task-specific sites (Binford 1980). Through time and in response to an increase in human population, and/or a reduction in carrying capacity due to climatic change and/or technological innovations, a shift is expected toward a more logistically oriented system. In that system, groups of "collectors" supply themselves with specific resources procured by organized task groups, wherein residential mobility decreases and functionally specific sites become common (Binford 1980). Along a spectrum of hunter-gatherer land use types all, or at least most, systems are probably intermediate to foragers and collectors. Viewed from this perspective, the evolutionary trend in the middle Kootenai Valley is expected to be toward a more collector-like system.

It is in this sense that the model predicts an overall intensification of land use systems.

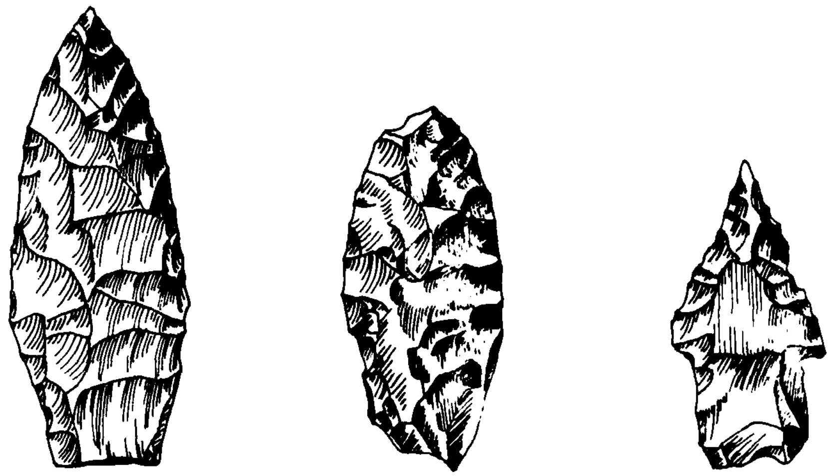
To determine whether or not the model is valid in any sense, it is necessary to detect and measure changes in the intensity of land use. One way to do this is to demonstrate a shift from single season to multiple season utilization of the project area. For example, increases in the frequencies of sites with poor solar exposures might be expected to indicate more summer time occupation. Also, an increase in the frequency of sites near permanent water could well indicate more dry season or summer occupation. Another way to monitor intensification is to show that through time site locations changed from areas with relatively undifferentiated resource availability to areas with more diversified resources. Utilization of such areas would not necessarily mean that diverse resources were exploited more regularly. However, the kinds or frequencies of artifacts associated with sites would probably change through time if different resources were exploited with varying emphases.

To deal with change through time, it is necessary to establish a chronology as a means to classify sites according to their relative age. The relative chronology employed here is derived primarily from cross dating, using morphological similarities in projectile point form, supplemented by geochronological data. This is necessary because only one of the project area sites (24LN677) has been radiocarbon dated. However, many of the LAURD project sites are radiocarbon dated (Munsell and Salo 1979; Roll and Smith 1982), and some of the projectile points from these sites are similar to projectile points from the project area. Because of that, reasonable confidence can be assigned to the relative, projectile point chronology established here. Utilization of projectile points as time markers leaves much to be desired, but at present it is the best available approach. The nomenclature for time periods used here follows that of Mulloy (1958) and Reeves (1970).

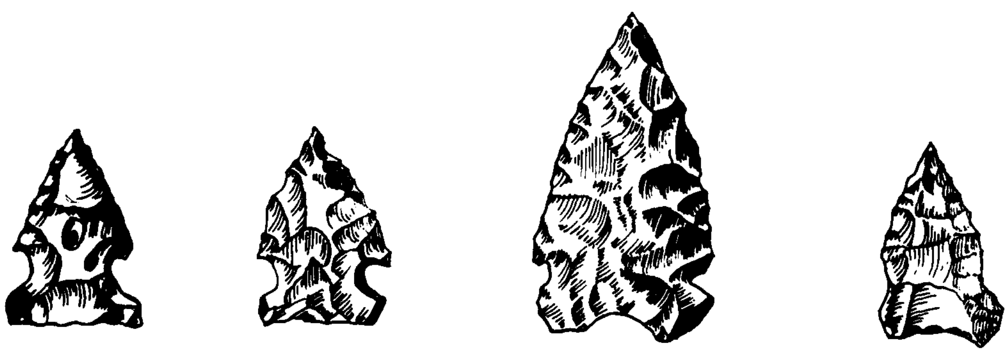
Period Markers

The term "period marker" is employed here to designate chronologically diagnostic projectile points and other artifacts. Period markers are used as indicators of time periods during which the sites yielding such artifacts were occupied. Fifty-eight sites or about 26 percent of the 224 recorded aboriginal sites contained artifacts representative of various general time periods (e.g., early Middle or Late Prehistoric Period). These sites include 48 sampled during this project and 10 sampled in the 1960s by Taylor (1973). The 48 sites for which collections are available yielded 161 relatively complete (i.e., enough so to be chronologically diagnostic) projectile points, plus beads and copper fragments from an additional five sites, including two collected in the 1960s.

It is widely held that projectile points that are large, lanceolate shaped (e.g., Plainview-like, Agate Basin-like, Lusk lanceolate-like, Figure 12-1, a-b) and large, stemmed, concave base specimens (e.g.,



a (24LN682-2) b (IA-44) c (24LN1054-239)



d (24LN1054-1202) e (24LN1054-435) f (24LN1054-430) g (24LN189-79/S/3)

Figure 12-1. Early Period diagnostic projectile points: large, lanceolate shaped a-b; and large stemmed concave base c; Early Middle Period diagnostic projectile points: large, side-notched d-e; and large "eared" and indented base f-g.

Windust-like and Pryor stemmed-like, Figure 12-1, c) are indicative of Early Period occupations (Swanson 1972; Frison 1978; Flint 1982). A total of 15 Early Period projectile points was recovered from nine sites and one isolated locality in the project area. Only one site--24LN1054--yielded more than a single Early Period marker. Although Early Period projectile points from the study area have not been dated, it is suggested that they represent a time period beginning at least 10,000 years ago and lasting through 8,000 or 7,000 years B.P. This time range is compatible with results from other studies in the Northern Rocky Mountains (e.g., Swanson 1972; Taylor 1973; Choquette and Holstine 1980; Flint 1982). Projectile points diagnostic of the Early Period predate those of the Bristow Phase in Roll's (1982) sequence for the LAURD project area. Despite the efforts spent in search of sites within the project area that could be assigned to the Early Period, 24LN1054 is the only reasonable candidate. However, the 15 Early Period projectile points represent 9.3 percent of the 161 relatively complete specimens. Thus while only one site is considered stratigraphically to have an Early Period component (see Chapter 7), the widespread but sparse occurrence of Early Period markers indicates the project vicinity probably was occupied, at least sporadically, by 9,000 years B.P.

Large side-notched (e.g., Bitterroot Side-notched-like, Figure 12-1, d-e) and large, "eared" and indented base (e.g., Oxbow-like, Figure 12-1, f-g) projectile points are considered to represent the early Middle Period. This project's collection includes 43 early Middle Period projectile points from 19 sites; similar specimens were recovered from three of the lower terrace sites tested in the 1960s (Taylor 1973). Stated simply, early Middle Period markers were recovered from 22 sites in the project area. Similar projectile points are considered representative of the early Plains Archaic Period (Frison 1978:40-46) and the Bristow Complex (Choquette and Holstine 1980:40-43), both of which are estimated to be more than 7,000 years old. Large, "eared", indented base points represent the Bristow Phase of the LAURD project (Roll 1982). Neither that type nor the large, side-notched type (i.e., Bitterroot side-notched-like) were common in the LAURD collection (Tom Roll 1984:personal communication). Following chronological assessments made by other investigators in the area (e.g., Munsell and Salo 1979; Choquette and Holstine 1980; Flint 1982; Roll 1982), it is suggested here that the early Middle Period dates from as early as 7,000 or 8,000 years B.P. to 4,500 years B.P. Such a time range is probably too wide. However, the important factor is that these large, "eared" and/or side-notched projectile points are older than those considered to be diagnostic of the late Middle Period. Whereas the LAURD project data (Roll 1982) indicate only minor utilization of the area prior to and during the Bristow Phase (ca. 5,450 to 4,450 B.P.), data generated by this project suggest more intensive occupation. The facts that the 43 large, "eared" and/or side-notched projectile points represent 26.7 percent of the relatively complete projectile points in the collection and that 22 (or 37.9%) of the 58 sites with diagnostic period markers yield such types, argues strongly for extensive occupation of the project area during the early Middle Period.

A wide range of projectile point styles is considered representative of the late Middle Period. These include large, indented base (e.g., McKean, Figure 12-2, a), large, short stemmed (e.g., Besant), medium corner- to side-notched (e.g., Pelican Lake Stemmed, Figure 12-2, e), large stemmed, straight base (e.g., Hanna Corner notched, Figure 12-2, f), large, wide-notched (e.g., Kutenai Plains side-notched, Figure 12-2, d), medium stemmed, concave base (e.g., Duncan/Hanna Stemmed, Figure 12-2, b), and large, corner-notched and barbed (e.g., Pelican Lake, Figure 12-2, c) projectile point styles. The names of projectile point types listed parenthetically are those employed by Reeves (1972, 1973) and Flint (1982). There are 54 late Middle Period projectile points in the collection recovered from 23 sites and similar specimens were recovered during the 1960s from 10 sites on the lowest terraces (Taylor 1973). Late Middle Period projectile points include the kinds of artifacts considered to represent the Calx (ca. 4,450 to 3,250 years B.P.), Kavalla (2,950 to 1,750 years B.P.), and Stonehill (ca. 1,750 to 1,250 years B.P.) phases in the sequence developed for the LAURD project area (Roll 1982). For this report the late Middle Period is considered to date between about 4,500 and 1,500 to 1,000 years B.P. Late Middle Period projectile points (including 5 isolated finds) represent 33.5 percent of the 161 relatively complete specimens in this collection. They were recovered from 33 or 56.9 percent of the 58 sites with diagnostic period markers. This distribution is suggestive of comparatively intensive occupation of the study area and is compatible with observations, by Taylor (1973:113), Choquette (1974:15), and Roll and Singleton (1982:6.3), that after about 3,000 or 2,500 years ago there is considerable evidence for intensive occupation of the study area.

Arrow size projectile points are considered herein to be indicative of the Late Period, lasting from about 1,500 or 1,000 years ago to about 200 years ago. These include the small, corner-notched and barbed (e.g., Blue Dome, or Mummy Cave Corner notched, Figure 12-2, g), small corner- to side-notched (e.g., Samantha side-notched or Columbia Valley corner-notched, Figure 12-2, h), small, corner-notched, concave base (e.g., Shaunavon truncated-base, Figure 12-2, i) and small side-notched styles (e.g., Plains side-notched, Figure 12-2, j and Avonlea), as well as arrow size, projectile point fragments. Parenthetically listed point types are defined by Kehoe (1966), Reeves (1970, 1973, 1974) and Flint (1982). There are 49 arrow size points in the collection recovered from 25 sites and one isolated artifact locality. An additional four sites on the lowest terraces yielded similar specimens during the 1960s (Taylor 1973). These types of points are considered representative of the Warex (ca. 1,250 to 750 years B.P. or A.D. 500 to 1200) and Yarnell (ca. 750 to 150 years B.P. or A.D. 1000 to 1800) phases of the LAURD project (Roll 1982). The 49 Late Period projectile points represent 30.4 percent of the relatively complete projectile points and they were recovered from half (29) of the sites with chronologically diagnostic artifacts. Considering that the Late Period is substantially shorter in duration than other periods, it is apparent that occupation of the project area during that time period also was intensive, probably more so than during the late Middle Period.

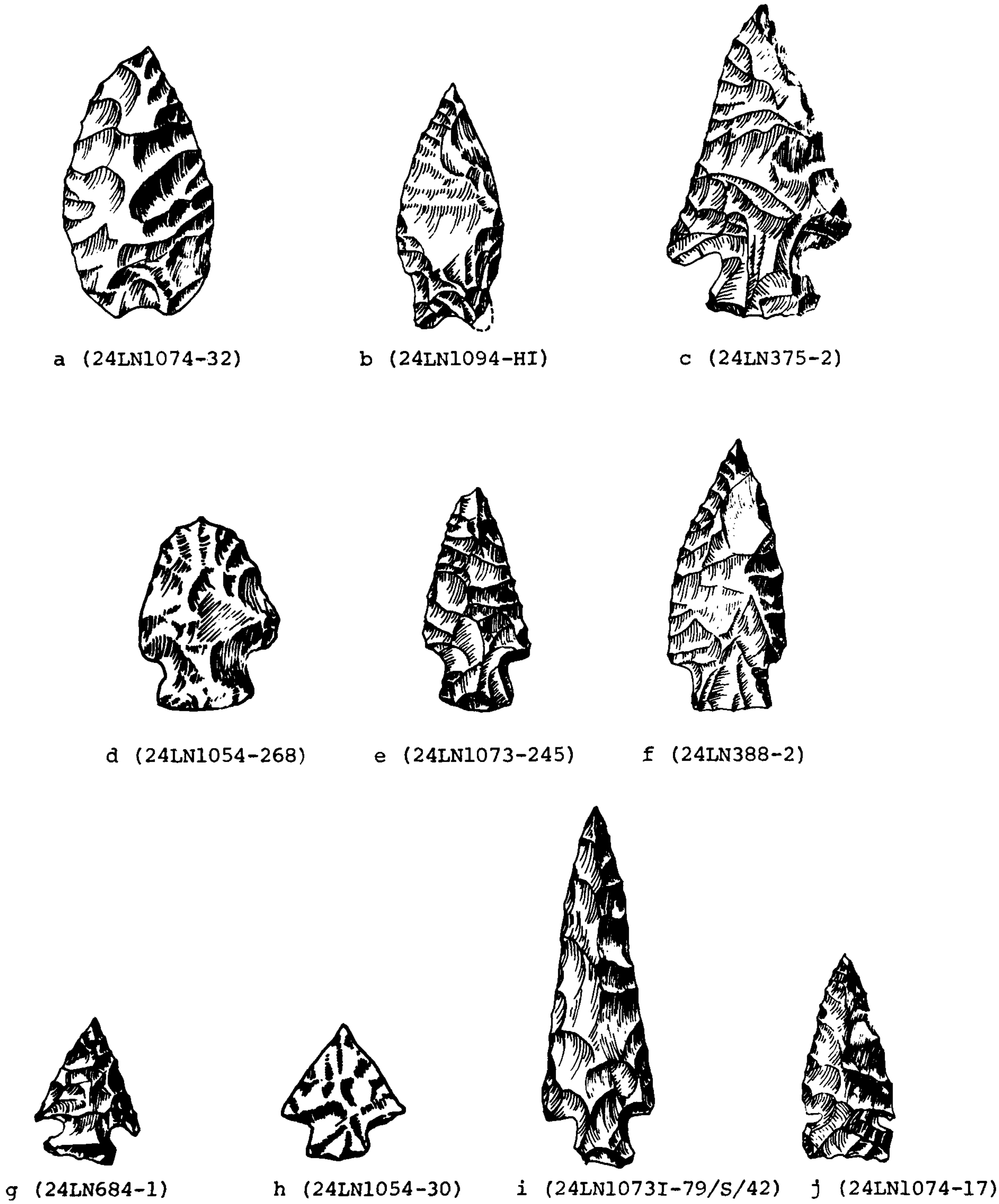


Figure 12-2. Late Middle Period diagnostic projectile points: (a) large, indented base; (b) medium stemmed concave base; (c) large, corner-notched and barbed; (d) large, wide-notched; (e) medium, corner- to side-notched; (f) large stemmed straight base. Late Period diagnostic projectils points: (g) small, corner-notched and barbed; (h) small, corner- to side-notched; (i) small, corner-notch, concave base; and (j) small, side-notched.

The Historic Period (ca. A.D. 1750 to 1800) is poorly represented compared to other periods, but it encompasses even less time. Glass or ceramic beads and historic copper artifacts are the diagnostic period markers and were recovered from five sites. It is recognized that some arrow points recovered from project area sites may be historic, but unless the site also contained historic aboriginal artifacts it was not considered to have a Historic Period component. Thus only five sites (i.e., 8.6% of the 58) are assigned to the Historic Period. Other things being equal, this would suggest that the project area was occupied less intensively during the Historic Period as compared to earlier periods, but this is unlikely. The Historic Period was only about one-fifteenth the duration of the Late Period, thus there was less time for Historic Period artifacts to accumulate on the landscape. Therefore, it may be that the project area actually was occupied about as intensively, if not more so, during the Historic Period than during the preceding period.

Site Components and Period Markers

The term "component," as traditionally employed has strong temporal implications in that it represents "phases" (Willey and Phillips 1958:21-22) or in even broader terms, "periods," as the latter term is utilized here. Projectile points, beads, and other period markers are used to assign sites to particular time periods which, in turn, are characterized by other cultural attributes, including, but not limited to, settlement and subsistence or land use patterns. Stated differently, when a particular site yields period markers (i.e., chronologically diagnostic artifacts) for the early Middle and Late periods it can be said to have two components, one being representative of the early Middle Period and the other of the Late Period.

As already noted, 58 sites in the project area yielded 161 relatively complete projectile points plus several beads and copper fragments, for a total of 166 available period markers. Each period marker is considered to be indicative of one of the five--Early, early Middle, late Middle, Late, or Historic--periods. The 30 sites yielding period markers representative of only one period are, in effect, single component sites, where as the 28 sites yielding artifacts considered to represent two are more periods are viewed as multicomponent sites (Table 12-1). Viewed from a component perspective, the 58 sites yielded period markers indicative of between one and five time periods for a total of 98 components. There are, then, at least three interrelated ways to view the chronological distribution of temporally diagnostic artifacts: (1) there are 98 components represented; (2) there are 58 sites with one or more identified components; and (3) there are 161 relatively complete projectile points (in the project's collection), plus five sites with Historic Period markers, for a total of 166 available period markers (Figure 12-3). It should be noted, however, that the 58 sites with one or more identified components, include 10 sites tested in the 1960s by Taylor (1973). Those sites are included in the component analyses, but not in the period marker analysis.

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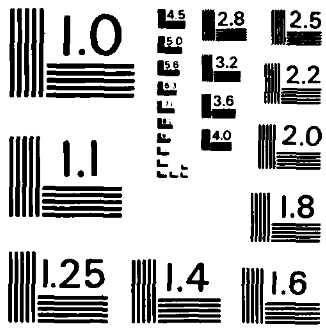
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Table 12-1. List of Single and Multicomponent and the Number of Recovered Sites Period Markers.*

Site Number 24LN....	Site Type	Early Prehistoric Period	Early Middle Prehistoric Period	Late Middle Prehistoric Period	Late Prehistoric Period	Historic (Native American) Period
7	Missing Data	-	-	-	+	-
189	Low Diversity	-	1	2	-	-
190	Low Diversity	-	1	1	-	-
191	Low Diversity	-	-	-	1	-
193	High Diversity	-	-	1	-	-
364	High Diversity	1	1	2	1	-
365	High Diversity	-	1	-	2	-
366	High Diversity	-	-	-	1	-
369	Low Diversity	1	-	2	-	-
375	High Diversity	-	-	1	-	-
382	Low Diversity	1	-	-	-	-
386	High Diversity	-	2	-	1	-
388	High Diversity	-	2	4	-	-
389	Low Diversity	-	-	1	-	-
394	High Diversity	1	-	-	-	-
397	Low Diversity	-	-	-	1	-
398	Low Diversity	-	-	-	1	-
399	Low Diversity	-	-	-	1	-
400	Low Diversity	-	1	1	-	-
417	High Diversity	-	-	-	4	-
423	High Diversity	-	-	1	-	-
427	Low Diversity	-	-	-	-	+
429	Low Diversity	-	2	-	-	-
443	High Diversity	-	-	1	1	+
501	High Diversity	-	-	+	-	-
502	High Diversity	-	-	+	+	-
503	High Diversity	-	+	+	-	-
504	Missing Data	-	-	+	-	-
505	Low Diversity	-	-	+	-	-
513	High Diversity	-	+	+	+	+

Table 12-1. (Continued)

Site Number 24LN....	Site Type	Early Prehistoric Period	Early Middle Prehistoric Period	Late Middle Prehistoric Period	Late Prehistoric Period	Historic (Native American) Period
517	High Diversity	-	+	+	+	-
520	High Diversity	-	-	+	-	-
521	Hist. Structure	-	-	-	-	+
522	Low Diversity	-	-	+	-	-
656	High Diversity	1	-	-	1	-
677	Low Diversity	-	-	+ (C-14 date)	-	-
682	Low Diversity	1	1	-	-	-
684	Low Diversity	-	-	-	1	-
688	Low Diversity	-	-	1	1	-
699	Low Diversity	-	-	1	1	-
706	High Diversity	-	-	1	2	-
711	High Diversity	-	-	1	1	-
712	Low Diversity	-	1	1	-	-
715	Low Diversity	-	-	-	1	-
1054	High Diversity	6	17	11	12	+
1055	High Diversity	-	2	-	-	-
1056	High Diversity	-	-	-	1	-
1058	High Diversity	-	2	1	1	-
1059	High Diversity	-	1	-	1	-
1060	High Diversity	1	-	1	-	-
1064	Missing Data	-	1	-	-	-
1066	Low Diversity	-	1	-	-	-
1072	Low Diversity	-	-	-	1	-
1073	High Diversity	1	4	7	7	-
1074	High Diversity	-	1	5	2	-
1075	Low Diversity	-	-	-	1	-
1086	Low Diversity	-	1	1	-	-
1094	Low Diversity	-	-	1	-	-
Isolated Finds		1	-	5	1	-

*Key to Table 12-1:
- \- diagnostic artifacts not recovered
- \+ diagnostic artifacts recovered but not available during this project
- 1, 2, 5, 11, etc.: the number of diagnostic artifacts recovered

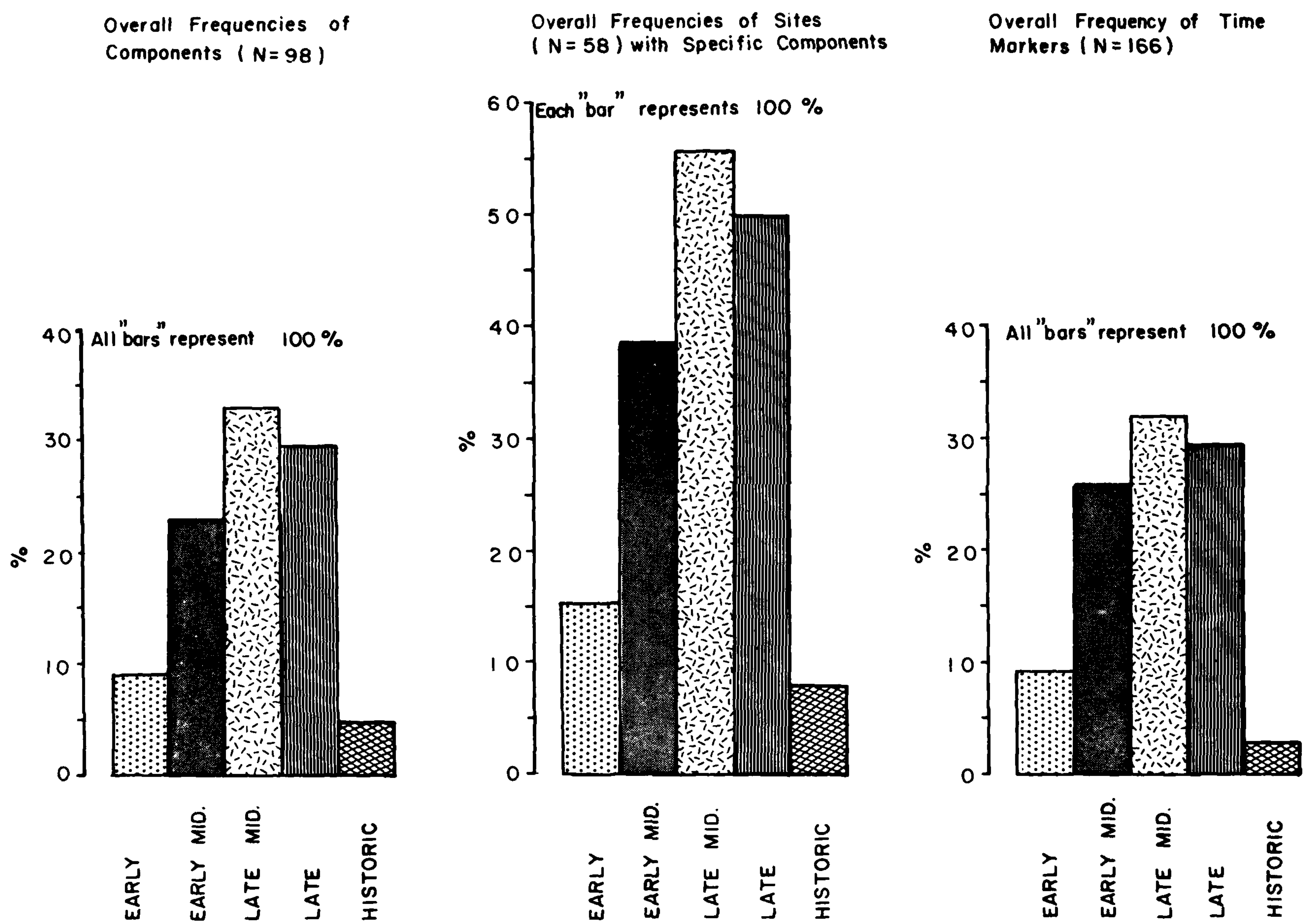

Figure 12-3. Three histograms of relative frequencies for components or period markers present in the sample.

Land Use Patterns and Time Periods

In light of theoretical expectations and available data, land use patterns for each period can be characterized and some tentative explanations offered. The following statements should be viewed as first approximations of land use systems during different time periods in the middle Kootenai Valley. In this very general approach the Early and early Middle periods are combined as are the Late and Historic periods. This procedure maintains the relative chronological order of periods while equalizing sample sizes (in terms of numbers of artifacts, sites, and components). The concern here is primarily with the distribution across the landscape of sites assignable to broad time periods (Table 12-2). It does not deal explicitly with assemblage varibility specific to periods. Based on available information from multicomponent sites, it would be unreasonable to make temporal associations of artifacts merely because they were recovered from the same site. Such inferences require detailed intrasite analyses. For a discussion of the limited data on artifact assemblages by time period the reader is referred to Chapters 8 and 11.

Approximately 31.6 percent (31) of the 98 identified components are indicative of the Early/early Middle Period. Stated another way, 46.6 percent (27) of the 58 sites have an Early/early Middle component. Compared geographically, these components are best represented in the Lower Canyon zone and are poorly represented in the Tobacco Plains zone. There are few Early/early Middle components located on low terraces and, in general, the components have better solar exposures than do those representing other periods. Only 16.1 percent of the components are within 100 m of a permanent water supply. The high frequency of sites far from permanent water and of sites with good solar exposures are interpreted as an indication of winter occupation. In general, sites with early Middle Period points, and to a lesser degree sites with Early Period points, tend to have a wider range of tools in comparatively higher frequencies than do later period, single component sites (see Chapter 11). All things being equal, this suggests that many of these sites may be residential camps. None of the Early/early Middle components are within the small site size category and only four early Middle sites are single component sites. Less than 13 percent of the Early/early Middle components are situated on the lower terraces. Collectively, these data indicate that the same spots on the landscape tend to be reoccupied through time and that the higher terraces were favored site locations. Of the 26 sites with enough data to be classified, 16 or 61.5 percent are high diversity sites. The overall land use pattern seems to support the contention that the early Middle and Early Period groups operated as foragers. This interpretation is made partially because residential (i.e., those with a wide range of tool types) camps appear to be numerous. Although there are ten low diversity sites in this group, none are small in size, and that may be a further indication that Early/early Middle Period sites are primarily residential camps.

It is clear that the late Middle Period is better represented than the early Middle Period. Projectile points diagnostic of the late

Table 12-2. Comparison of Selected Characteristics for the 98 Identified Components of 58 Sites.

Characteristics	Early/Early Middle Period N	Early/Early Middle Period %	Late Middle Period N	Late Middle Period %	Late/Historic Period N	Late/Historic Period %	Totals N	Totals %
Reservoir Zone								
Lower Canyon (Southern)	18	58.1	10	30.3	13	38.2	41	41.8
Upper Canyon (Central)	5	16.1	5	15.2	5	14.7	15	15.3
Tobacco Plains (Northern)	8	25.8	18	54.5	16	47.1	42	42.9
Solar Exposure								
Poor (NE, N)	1	3.2	2	6.1	4	11.8	7	7.1
Moderate (W, NW, E, SE)	14	45.2	16	48.5	17	50.0	47	48.0
Good (S, SW)	16	51.6	15	45.4	13	38.2	44	44.9
Terrace Setting								
Low (T-1 to T-4)	4	12.9	12	36.4	10	29.4	26	26.5
Middle (T-5 to T-6)	16	51.6	13	39.4	15	44.1	44	44.9
High (T-7 to T-9)	11	35.5	8	24.2	9	26.5	28	28.6
Distance from Permanent Water								
Near (0-99 m)	5	16.1	8	24.2	7	20.6	20	20.4
Moderate (100-299 m)	9	29.0	7	21.2	12	35.3	28	28.6
Far (300 or more m)	17	54.9	18	54.6	15	44.1	50	51.0
Site Size								
Small (less than 1,000 m^2)	0	0.0	3	9.1	3	8.8	6	6.1
Medium (1,000-6,000 m^2)	14	45.2	14	42.4	11	32.4	39	39.8
Large (more than 6,000 m^2)	17	54.8	16	48.5	20	58.8	53	54.1

Middle Period are present at 33 of the 98 identified components; 33 (56.9%) of the 58 sites yielded late Middle Period markers, including the C-14 date from 24LN677. Compared with the preceding period, there are fewer components in the Lower Canyon zone and more components in the Tobacco Plains zone. The late Middle components are more evenly distributed in terms of terrace placement than are those representing the other periods. The frequency of components with poor solar exposure is slightly higher than for the Early/early Middle and the Late periods. A higher percentage of late Middle components are located within 100 m of permanent water in comparison to the other two periods. Whereas there were no small sites with an Early/early Middle component, 9.1 percent of the late Middle components are at small sites. Furthermore, there are almost three times as many single component sites in comparison to the early Middle Period. Collectively, these data indicate a trend toward year-round or at least dry-season occupation. Further evidence for intensification of land use is the marked increase in diversity of site locations. It can be suggested, although it has yet to be demonstrated, that plant and fish exploitation also increased during this time. There is an apparent reduction in the number of large residential camps, and an increase in small task-specific sites. However, in terms of site types, 18 or 62.1 percent of the 29 sites are high diversity sites. This aspect is little changed from the Early/early Middle Period. Even so, the overall trends suggest a tendency toward intensification of the land use system with a slight change toward a collector orientation.

The combined Late/Historic Period is better represented than the late Middle Period. The locations of components are different, compared to other periods, in that they occur in similar frequencies in the Lower Canyon and Tobacco Plains zones. The components are well distributed on the various terraces but not as evenly as during the preceding period. The Late/Historic components also have the highest frequency of poor solar exposures. Considering only single component sites, the Late/Historic sites are larger and have more FCR features than do those of previous periods. Furthermore, more of the large single component sites (e.g., 24LN417) have poor solar exposures. However, the frequency of single component sites is only slightly higher than for the preceding period and proportionately, there are fewer small sites. Interestingly, there is a tendency for the smaller sites with Late/Historic components (e.g., 24LN688, and 24LN711) to be sequestered, in the middle of landforms and in cove-like areas. Of the 32 sites with classifiable data, 18 or 56.3 percent are high diversity sites. Consequently, the Late/Historic Period has the highest frequency of low diversity sites. If task specific sites other than those related to hunting are represented in the study area, they are most characteristic of the Late/Historic Period. As a whole, these data are interpreted as indicating a more intensive land use system than during other periods. Population densities also may have increased during the Late Prehistoric Period, judging from the number of large sites with many FCR features and considering the fact that small sites are better represented than for any other period. Since all but one of the sites with more than 15 fire-cracked rock features have a Late Prehistoric component, it seems reasonable to suggest that either the utilization intensity of a few

residential camps increased dramatically, or the population increased, or both. In any case, the overall picture appears to be one of decreased residential mobility coupled with an increase in logistic mobility. Stated differently, the trend away from a strict forager strategy and toward one with elements of a collector strategy appears to continue. This trend is somewhat evident during the late Middle Period, but certainly it is obvious when the Early/early Middle and Late/Historic periods are compared..

Discussion

On the basis of existing data it would be difficult to argue that any of the prehistoric groups who utilized the study area were logistically organized collectors, as defined by Binford (1980). To argue for a collector strategy implies that stored food provided much of the diet for at least part of the year, that residential sites were at least semipermanent and located in proximity to critical resources, and that functionally different, task-specific sites were common. However, the data do not support such an argument, short of arguing that the base camps (i.e., villages) were located somewhere else. In this regard it is recognized that a number of investigators (e.g., Taylor 1973; Choquette and Holstine 1980) have speculated about the presence of and searched for winter villages in the region, but none has been found archaeologically. The ethnographic record (Smith 1984) may well support the claim that the historic Kutenai employed a collector strategy, but historically documented "villages" also are notoriously difficult to find on the ground.

Tentative explanations can be offered for the patterns just discussed. It is possible that the density and distribution of sites in this part of the Kootenai River valley is unique or unusually high compared to surrounding areas, but this seems unlikely. Based on the authors' field experiences along high terraces between Bonners Ferry and Libby, as well as brief excursions up the Fisher River valley, the distribution of sites in those areas is probably comparable to Libby Reservoir. In fact, sites situated on high terraces at considerable distances from riverine settings are recorded in the Clark Fork River valley (Malouf 1982), in the vicinity of Waterton Lakes, Alberta (Reeves 1972, 1973, 1974), in the various Flathead River valleys (Fredlund and Fredlund 1971) and around Flathead Lake (Malouf 1956a). More detailed investigations in the surrounding areas would provide the data necessary to determine whether or not site densities and locational patterns in Libby Reservoir are atypical for the region.

The apparent shift in settlement location to the northern or Tobacco Plains zone may be partially in response to vegetation changes that led to a reduction in the abundance of browse plants and grasses. In other words, people might well have used the Tobacco Plains zone in increasing frequencies because the game animal density was decreasing in more forested areas. The pollen record provides some support for this idea. During the last 7,000 years, the forests have become more dense, although not at the same rate (Mack 1982; 1983:personal communication).

In general terms, there may have been an overall reduction in the availability of browse plants and grasses as the forest canopy became more dense, limiting sunlight and plant growth on the forest floor. As has been discussed, it is known that aboriginal groups may have used controlled forest burns in an effort to increase game production for at least the last six centuries of the prehistoric record (Barrett 1981). Mehringer et al. (1977:366) suggested that perhaps the increased frequency of forest fires some 2,000 years ago could reflect "changing patterns of aboriginal land use and resource management." It may not be coincidence that the most intensive use of the project area and the onset of burning in the region, both occur during the late Middle Period. If controlled burning was part of the intensification pattern in the aboriginal land use system, then it may have been in response to either increased forest cover or increasing human population or both.

Through time human population densities probably increased throughout the region. That increase may have been a forcing variable that led to intensification of land use including diversification in the types of food resources routinely exploited by local groups. Technological developments such as the introduction of the bow and arrow probably are responsible to some degree for changes in hunting strategies. There can be little doubt that changes in land use patterns are caused by the interrelated and dynamic processes of environmental changes, human population increases, and technological developments. The challenge, however, is still to sort through the complex maze of variables and develop reasonable explanations for these directional changes.

Differences Between Ethnographic and Archaeological Records for the Libby Reservoir Area

The land use systems described in Kutenai ethnography do not strongly resemble those inferred from the archaeological record of Libby Reservoir. The ethnographic record suggests that the Kutenai lived in large settlements located on prairies such as the Tobacco Plains where horses could be grazed. Bison hunting in the eastern foothills of the Rockies represented the focus of the economy and required as many as three trips per year for that purpose. Food storage as practiced to a considerable extent and, combined with the transport capabilities of horses, supported relatively long duration occupations at particular camps. By contrast, archaeological investigations in the Libby Reservoir area have revealed no evidence for large villages at any time period. Although such villages may have existed in areas outside the project area during the historic period, archaeological evidence from this study suggests the presence of small, dispersed, and highly mobile hunting bands. Significant dependence upon long-term food storage is contradicted by the absence of archaeological remains that would be expected to be associated with semipermanent occupations (e.g., dense midden-like deposits, heavy investments in housing or other domestic facilities, cemeteries, etc.). In general, the differences between the archeeological and ethnographic records can be accounted for

largely by changes that occurred as a direct or indirect result of Euroamerican influences.

Smith's (1984) analysis of ethnographic and historical sources on the Kutenai lends independent support to most of these suggestions. Many inconsistencies among the various ethnographic sources and between those sources and the archaeological record can be accounted for by a diachronic perspective like that proposed by Smith. He postulates a dynamic series of phases in subsistence and settlement for the Kutenai between 1650 and 1900. Smith suggests that the prehorse Kutenai lived in smaller, more widely dispersed settlements and that subsistence involved a balanced dependence upon game, fish, and plant resources available within the Kootenai Valley. On the one hand, acquisition of horses and guns offered the technological capability to overhunt local game resources and, on the other hand, development of a market for hides with the opening of the fur-trade in this region in the early 1800s, provided the incentive to do so (Smith 1984; Chance 1981). Expansion of dependence upon bison hunting east of the mountains, development of a few larger villages located in areas of extensive pasture for horses, increased reliance upon food storage, and reduced dependence upon locally produced game, fish, and plant resources, all might be viewed as associated developments during this brief interval. With the disappearance of the bison during the second half of the nineteenth century, the Kutenai were once again faced with subsisting on resources that were available locally in the Kootenai Valley (Smith 1984). The importance of plant resources reported in ethnographic sources contrasts sharply with the archaeological record which seems to indicate the overwhelming importance of hunting in subsistence. This contrast, in part, may derive from a kind of "forced vegetarianism" caused by depletion of bison and game resources available in the Kootenai Valley.

In summary, analysis of the ethnographic and historic literature leads to the conclusion that "traditional" Kutenai land use systems described by ethnographers developed only after A.D. 1800. It should, therefore, not be surprising that there is poor correspondence between the land use systems inferred from ethnography and the prehistoric archaeological record. There is ample reason to believe that the century between A.D. 1750 and A.D. 1850 was one in which land use changes were more profound than at any other interval during the preceding 10,000 years.

CHAPTER 13

THE SIGNIFICANCE AND POTENTIAL OF IDENTIFIED CULTURAL RESOURCES AT LIBBY RESERVOIR

by
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This chapter is an examination of the results of the fieldwork and analyses in relation to the research design and criteria established for inclusion of properties in the National Register of Historic Places. Early in this report a series of research questions or objectives were outlined and it was argued that data derived from analyses could be used to address those questions. The specific research questions are addressed here as are the broader issues related to the assessment of the project area's cultural resources in terms of criteria established for the National Register and in terms of cultural/heritage values in general.

The National Park Service has established the framework within which significant cultural resources on federal lands are defined and assessed. This framework, the "Criteria for Evaluation," is specified in 36 CFR 60.4 (US Government 1981b). In the significance discussions that follow, specific National Register criteria are referred to under two general categories of significance, scientific and cultural.

Scientific Significance

Cultural resources "that have yielded, or may be likely to yield, information important in prehistory or history" are considered to be potentially eligible for the National Register if they also are determined to have integrity (US Government 1981b). Application of scientific significance criteria is accomplished most effectively through discussion of research questions for which cultural resources in the project area already have yielded or have the potential to yield relevant data. The following general research domains are identified:

1. Long-term trends in hunter-gatherer land use systems. There are several important reasons for suggesting that the Libby reservoir has unequalled potential for the study of hunter-gatherer land use systems and how those systems changed during the past 10,000 to 8,000 years in the montane, coniferous forest setting of the Northern Rockies. One important factor here is that the surface archaeological record has been laid bare as a result of erosion caused by forest clearing and the operation of Lake Koocanusa. As noted previously, continuing erosion eventually will destroy many of these resources and adversely affect most of them. Nevertheless, during the interval that erosion is still actively exposing the

sites and their contents, an unprecedented archaeological data base is available. The annual drawdowns and their associated effects have produced excellent ground surface visibility over thousands of acres of river valley extending for a distance of more than 50 miles. The high site frequencies revealed in the years following the initial operation of the reservoir offered an entirely different view of the archaeological record than previously documented elsewhere in the Northern Rockies. There is probably not another area of similar vertical and horizontal extent along a major river valley in the Northwest for which there is currently site distribution data that approximate the quality of those available for Libby Dam-Lake Koocanusa. A large number of sites are inventoried which ordinarily would be overlooked and remain undocumented in most archaeological surveys using traditional techniques in a montane forest. Under prereservoir conditions of vegetation and ground cover, the cost of acquiring the archaeological data now available for the project area would have been much higher because extensive subsurface investigations would have been necessary to achieve the degree of site exposure caused by the normal operation of the reservoir.

A second quality of this reservoir that contributes to its scientific potential for the study of long-term trends in land use is that most landforms have remained stable since the early Holocene. Owing to rapid downcutting of the Kootenai River after glacial retreat, the culture bearing deposits capping landforms have not undergone dramatic change during the past 8,000 or more years, and generally there has been little deposition of sediments during this interval. Because of these low rates of deposition, few sites were buried deeply, and post-impoundment erosion throughout the reservoir has exposed extensive surfaces which are literally pavements of nonperishable items that humans have dropped over that 8,000 year interval. The Holocene archaeological record on terrace remnants has not been transformed by geological processes as have the floodplains and immediately adjacent terraces along the Columbia and Snake rivers. In general, geological processes above the second terrace favor preservation, at or near the modern ground surface, of remains deposited during the past 8,000 or more years.

Knowledge about paleoenvironments of this region, gained through this project as well as through related geologic (Cochran and Leonhardy 1982) and palynological studies (Mehringer et al. 1977; Mack, et al. 1983), constitutes a third factor contributing to the scientific potential for investigation of human land use systems. This region is of special and continuing interest to both Quaternary geologists and palynologists due to its proximity to the southern margin of the Cordilleran ice sheet. A solid foundation is being laid for understanding climatic change as well as its effects upon vegetation since glacial times. That foundation, built in part from data derived from this project, is a prerequisite for effectively investigating the response of past human land use systems to changing environments.

Archaeological knowledge about this region has grown rapidly over the past decade. The University of Montana's work (Taylor 1973) concentrated primarily, though not exclusively, on late Middle Period and Late Prehistoric sites. In terms of landforms, most of the sites investigated were on the lowest terraces (i.e., T1, T2, and T3). These terraces were inaccessible during the present project. Hence, the 1981 and 1982 work complements earlier studies because it focused on T4 and higher terraces. Similarly, the survey, testing, and data recovery efforts undertaken downstream from the Libby Reservoir, by the University of Idaho (Munsell and Salo 1979; Rice 1979) and Montana State University (Roll 1979; 1982), produced a body of information that complements that from this project. Most of the known sites below Libby Dam also are on lower terraces, primarily T1, T2, and T3, and are assignable to the late Middle and Late Prehistoric periods. These previous studies, when combined with the high quality of survey and testing level data obtained during the present project, constitute a substantial archaeological data base for the region. Knowledge regarding these adjacent areas enhances the scientific potential of cultural resources in the project area. The more that is known, the more efficiently can scientific methodologies define research questions and select the most fruitful methods for pursuing them. In the Libby Dam-Lake Koocanusa area, present knowledge suggests that future investments of time and money should bring disproportionately large returns in terms of new understanding, because the more goal-oriented research is, the more efficient it tends to be. Deficiencies in the current archaeological data base for this region can now be appraised reliably, and realistic strategies for overcoming those deficiencies can be developed.

Several kinds of data are obtainable and/or have been generated that relate directly to the question of long-term trends in hunter-gatherer land use systems. Site locational data (e.g., distance from water, terrace setting, solar exposure, zonal placement) are of particular interest because they permit the definition of settlement patterns. Chronological data (e.g., mainly projectile point styles, C-14 dates, and identifiable volcanic ash layers) provide a temporal framework within which changes in settlement patterns can be assessed. Paleoenvironmental data and reliable information on the kinds of tools present at sites provide a means to understand how climatic factors conditioned subsistence patterns through time or space. In turn, paleoenvironmental data are necessary for identifying the nature and degree of human influences on the ecosystem.

By combining chronological and locational data, some of the long-term changes in land use patterns have and can be defined. For example, through time there is a decrease in the occupation of the Lower Canyon zone coupled with an increase in the occupation of the Tobacco Plains zone. Occupation of the Upper Canyon zone remains essentially the same through time. Overall, these changes reflect a long-term trend, toward increased utilization of the Tobacco Plains, that may be related to increasing population densities and later to the introduction of the horse.

Analysis of the data also indicates that through time the number of sites with poor solar exposures increased. Furthermore, the number of sites located near permanent water sources also increased. These kinds of patterns may be indicative of a trend toward more summer season occupation.

Finally, faunal collections from archaeological sites are particularly valuable in monitoring change in site function and seasonality as these respond to widespread climatic trends. However, faunal remains are presently limited for the region.

2. Human adaptation at the southern margin of the boreal forest. Viewed from the perspective of the major environmental zones of North America, the Northern Rockies represent a southerly extension of the northern coniferous or boreal forest. Because of its positioning at the edge of this vast environmental zone, and because of certain other environmental factors, the middle Kootenai Valley is ecologically a distinctive region of the boreal forest. Contributing to this is the fact that moderate, maritime climatic influences from the Pacific Ocean extend into this mountainous region, although the region is also affected by the more severe, continental conditions typical of the northern Great Plains. The coincidence of these environmental conditions is of considerable importance for identifying what appear to be a unique combination of food resources. The suspected food resources pattern, in turn, provided a unique set of problems and opportunities for the prehistoric occupants of the area.

The most salient consequence of these environmental factors may be a greater diversity of large herbivores than is typical in other regions of the boreal forest. White tailed deer, mule deer, elk, mountain sheep, moose, caribou, and mountain goat are all native to this region. Bison, in small numbers, apparently can be added to this list for some time periods. Bears are also native to the region and at times in the past their populations have been high. Although some of these species were never numerous and a high carrying capacity cannot be assumed, the diversity of large herbivores implies a comparatively greater resource "security" for human populations, should herbivore populations fluctuate.

Without overemphasizing the importance of plant food resources in this region, it appears that this resource class also was more diverse and productive than is generally the case in other boreal forest regions. This may be a function of the climatic patterns and geographic position of the area, as noted previously, as well as of the considerable topographic relief which the area possesses.

The montane topography further distinguishes the food resources of this region from those in boreal settings of lower relief. It is likely that the elevational zonation of climate and vegetation produces a greater degree of seasonal migration and a less homogenous distribution of game populations than is expected in other settings with lesser relief.

(e.g., 24LN388, 24LN417, 24LN423, and 24LN656). This type of analysis involves resorting cultural materials according to intrasite provenience and spatial association with identified features. The resulting information would provide general chronological controls necessary to isolate and define artifact and feature assemblages that are expected to reflect long-term trends in hunter-gatherer adaptations.

Further analyses also should include wear pattern studies of the various kinds of tools in the assemblages. Wear pattern analysis should be undertaken in conjunction with a study of lithic tool manufacturing technologies, as well as determining the sources of lithic raw materials. These analyses require more detailed descriptions and measurements of lithic tools and debitage. They also necessitate a more exhaustive review of existing literature as a means to establish a comparative data base. These studies should permit a more accurate assessment of site function and variability.

To summarize, the kinds of analyses already conducted are primarily descriptive in nature. Although they are of sufficient scope to demonstrate the cultural resources of the project area are potentially significant in terms of National Register criteria, that potential remains to be realized. Realization is dependent upon further analyses and other aspects of a final mitigation effort. Further analyses should be more exhaustive and comparative than those already conducted. These analyses require, but are not limited to, more comprehensive literature reviews, more exhaustive manipulation of existing data, and generation of new data through wear pattern, assemblage and related lithic technology analyses. All analyses should be conducted in the context of a final research design.

Data Recovery at Selected Sites

Excavations are recommended at sites 24LN704, 24LN1054, and 24LN1058. These sites have been tested thoroughly and it has been established that they contain sealed deposits of cultural material that represent different cultural periods. An adequate sample of the buried portions of these sites probably would require block excavations. All data recovery methods should be consistent with those outlined in the Handbook for Treatment of Archaeological Properties (Advisory Council 1980).

As noted, 24LN704 is potentially significant because it appears to be a late Middle or Late Prehistoric Period, single occupation site. Excavation of this low diversity site is likely to yield important information concerning site function and seasonality. Its abundant lithic artifacts are likely to provide information useful in interpreting lithic technology and tool function. The results would be important in interpreting other sites with similar artifacts.

Site 24LN1054 is a large--13,600 m^2--site in the Bristow Tract that appears to contain the oldest and best preserved cultural resources in the project area. Diagnostic artifacts recovered from this high

recommended for sites in the Kootenai Flats/Tobacco Plains and Lower Canyon Area tracts. Only two sites--24LN1054 and 24LN1058--in the Bristow Tract are recommended for additional fieldwork. Recommendations for no additional work at other sites are contingent upon the results of the proposed monitoring effort discussed later. In other words, new information about known sites could be discovered during the monitoring effort and be of such a nature (e.g., hearths with abundant charcoal for dating) as to require additional fieldwork. These and other possibilities must be recognized and addressed in the final research design developed to guide the overall mitigation effort.

Further Analyses

The kinds of analyses conducted for purposes of the present project were sufficient to illustrate the general nature and distribution of cultural resources in the project area. Furthermore, they were of sufficient scope to address the research questions and even to develop new ones, but the analyses conducted to date are far from being adequate for mitigation purposes. Analyses already performed are primarily univariate descriptive statistics for the cultural resources and their distributions, although some bivariate analyses (e.g., cross tabulation of landform by site condition variables) have been carried out. Results of these analyses demonstrated that the resources have potential to contribute significant information in terms of the criteria established for National Register eligibility. Further analyses of the data generated as a result of the present project are required, if the cultural resources' potential to contribute significant information in terms of the identified research domains (see Chapter 13) is to be realized.

Further analyses should emphasize intrasite structure and variability, intersite assemblages, and locational variability. A more thorough investigation into past environmental conditions also should be undertaken. In so far as is practical, detailed comparisons should be made with the results of archaeological investigations in and around the Northern Rocky Mountains. These kinds of investigations provide the environmental and cultural information necessary to understand long-term trends toward sedentism and to assess more accurately the practice of subsistence related burning.

A thorough evaluation of site locational data is necessary to understand long-term trends in the land use systems. Such an analysis should include the use of multivariate techniques (computer assisted) that consider a number of variables (e.g., solar exposure, distance to water, type of landform, foraging space) in defining and explaining site location patterns. In this case existing information would be analyzed in greater detail and interpreted as a means to understand trends in hunter-gatherer land use systems and to detect increasing sedentism at the southern margin of the boreal forest.

A study of the horizontal distribution of artifacts and associated features should be undertaken at sites with representative collections

prior to impoundment. In the case of the Libby Dam-Lake Koocanusa project, postimpoundment discoveries revealed numerous cultural resources not identified or evaluated in the original salvage program.

Second, the potential for site recognition in most reservoir survey projects, and certainly those in a forested environment like that of northwestern Montana, would have been markedly inferior compared to this project. Exceptional visibility of the ground surface resulted from both naturally slow rates of deposition, and erosive processes associated with several years of reservoir operation. These factors contributed to the identification of a much larger percentage of the sites in the "target population" (Thoms 1979) than is typical. Besides identifying more sites, the present survey and testing project has been less biased towards large, high artifact density archaeological sites.

Third, because the project involved a larger population of sites, including many small, low-density, and shallowly buried sites, the data base differs from that for any surrounding area.

Fourth, surface collecting and mapping were done to a greater extent and on a larger number of sites than is typical of reservoir projects in the Northwest. In particular, the surface collections constitute a larger, more representative sample of artifacts than ordinarily would be recovered by test excavating sites with buried cultural materials.

In summary, the distinguishing features of this project are especially relevant to planning future mitigation and research efforts. An exceptionally good body of site distributional data is available. Characteristics of these sites favor surface collecting (and mapping) as the most effective form of data recovery and a substantial number of sites already have been surface collected. Many of these collections provide adequate samples of site contents. Because of this combination of factors, the analytical potential of the existing body of archaeological data greatly exceeds the analysis that was possible or appropriate for purposes of this project.

It is argued here that potentially significant information and cultural materials have been recovered from most of the known sites, but from an analytical perspective that potential remains to be realized. This does not mean that the sites within and outside the proposed District tracts are not significant. Rather, it means that efforts to mitigate the reservoir's adverse effects should focus on analyses rather than on more testing or data recovery. The quality and quantity of locational information and cultural materials already collected from known sites (with four exceptions) is considered to constitute an adequate sample of the potentially significant data categories they embody.

For the reasons already noted, additional fieldwork is not recommended for sites located outside the bounds of the proposed District tracts, with the exception of in-place preservation at 24LN370 and data recovery at 24LN704. Neither is additional fieldwork

sites. In that sense cultural resources encompassed by Lake Koocanusa are complementary to those preserved in the Libby/Jennings Archaeological District. Stated differently the proposed discontinuous archaeological district for the Libby Dam-Lake Koocanusa project would preserve a set of related cultural resources that have not been represented previously. "Middle Kootenai River Archaeological District" would be an appropriate designation for a property consisting of the Kootenai Flats/Tobacco River, Upper Canyon Area, and Bristow tracts, as well as outlier sites 24LN704 and 24LN370. Recognition of the fact that the Libby/Jennings and "Middle Kootenai River" archaeological districts contain different manifestations of related behavioral activities would tend to encourage future archaeological investigations that are nonduplicative and comprehensive at a larger geographic scale. In many respects, the present survey also is complementary to archaeological studies of the Canadian portion of Lake Koocanusa.

Detailed knowledge about cultural resources in nearby areas is integral to understanding land use patterns in the project area. Because of the emphasis on middle and high terraces in this survey, the number of identified early Middle Period sites is higher than in the areas immediately upstream or downstream. Additionally, emphasis in the present study has been extensive in contrast to the Reregulating Reservoir (i.e., LAURD) and Canadian projects which were more intensive. These adjoining areas probably were used by the same people at various times in the past. Thus the regional cultural resource data base can be made more complete through the integration of these local data bases during the course of future investigations. Clearly, multiple National Register districts composed of different elements serve as useful planning tools in that they protect a range of significant cultural resources. From the standpoint of contributions to existing knowledge, it is fundamental that the broader data base be investigated.

Preservation and Utilization of Project Area Cultural Resouces

A substantial amount of fieldwork and analyses have been required to demonstrate that the Libby Dam-Lake Koocanusa sites vary with regard to their contents and environmental settings and that they are potentially significant. A large number of sites has been tested and there are obvious patterns in the data indicating that recovery of the same kinds of information would not necessarily add to knowledge about past human behavior in the study area. An important problem in many cases, then, is the preservation of information rather than the in situ cultural resources. The circumstances surrounding this survey and testing project are atypical; therefore it is appropriate to reiterate the distinctive characteristics. Such a discussion clarifies why and how the recommendations for data recovery and related investigations depart from "standard operating procedures."

First, the "typical" approach to a reservoir archaeological survey and testing project is to design a plan that will provide for mitigation

Table 14-1. Known sites in the Kootenai Flat/Tobacco River tract.

Site number			
Northwest Kootenai Flats complex			
24LN444	24LN524	24LN1099	24LN1102
24LN445	24LN684	24LN1100	24LN1103
24LN451	24LN685	24LN1101	
Kootenai Flats Rim complex			
24LN188	24LN401	24LN438	24LN658
24LN366	24LN402	24LN439	24LN683
24LN398	24LN434	24LN440	24LN706
24LN399	24LN435	24LN441	24LN1098
24LN400	24LN437	24LN442	
Central Kootenai Flat complex			
24LN433	24LN657	24LN675	24LN696
24LN436	24LN673	24LN677	24LN705
24LN655	24LN674	24LN682	
Smiley's complex			
24LN425	24LN652	24LN1092	24LN1095
24LN448	24LN714	24LN1093	24LN1145
24LN449	24LN715	24LN1094	
Sophie Creek complex			
24LN426	24LN653	24LN666	24LN691
24LN427	24LN654	24LN667	24LN1142
24LN428	24LN659	24LN668	24LN1143
24LN429	24LN660	24LN671	24LN1144
24LN430	24LN661	24LN672	24LN1146
24LN431	24LN662	24LN676	
24LN432	24LN663	24LN682	
24LN521	24LN664	24LN690	
Tobacco River complex			
24LN9	24LN413	24LN420	24LN1063
24LN190	24LN414	24LN421	24LN1064
24LN191	24LN415	24LN422	24LN1086
24LN395	24LN416	24LN447	24LN1087
24LN396	24LN417	24LN488	24LN1089
24LN411	24LN418	24LN710	
24LN412	24LN419	24LN713	

Table 14-1. (continued)

Other sites			
24LN7	24LN514	24LN665	24LN1069
24LN8	24LN515	24LN691	24LN1090
24LN423	24LN516	24LN701	24LN1091
24LN424	24LN517	24LN1065	24LN1096
24LN443	24LN518	24LN1067	24LN1097
24LN452	24LN522	24LN1068	24LN1148

Table 14-2. Known Sites in the Bristow Tract.

Site number		
24LN365	24LN410	24LN1055
24LN381	24LN446	24LN1056
24LN382	24LN487	24LN1057
24LN404	24LN502	24LN1058
24LN405	24LN503	24LN1059
24LN406	24LN525	24LN1060
24LN407	24LN1052	24LN1061
24LN408	24LN1053	24LN1062
24LN409	24LN1054	

Table 14-3. Known Sites in the Upper Canyon Area Tract.

Site number		
24LN388	24LN699	24LN716
24LN389	24LN670	24LN1077
24LN390	24LN693	24LN1078
24LN590	24LN694	
24LN656	24LN695	

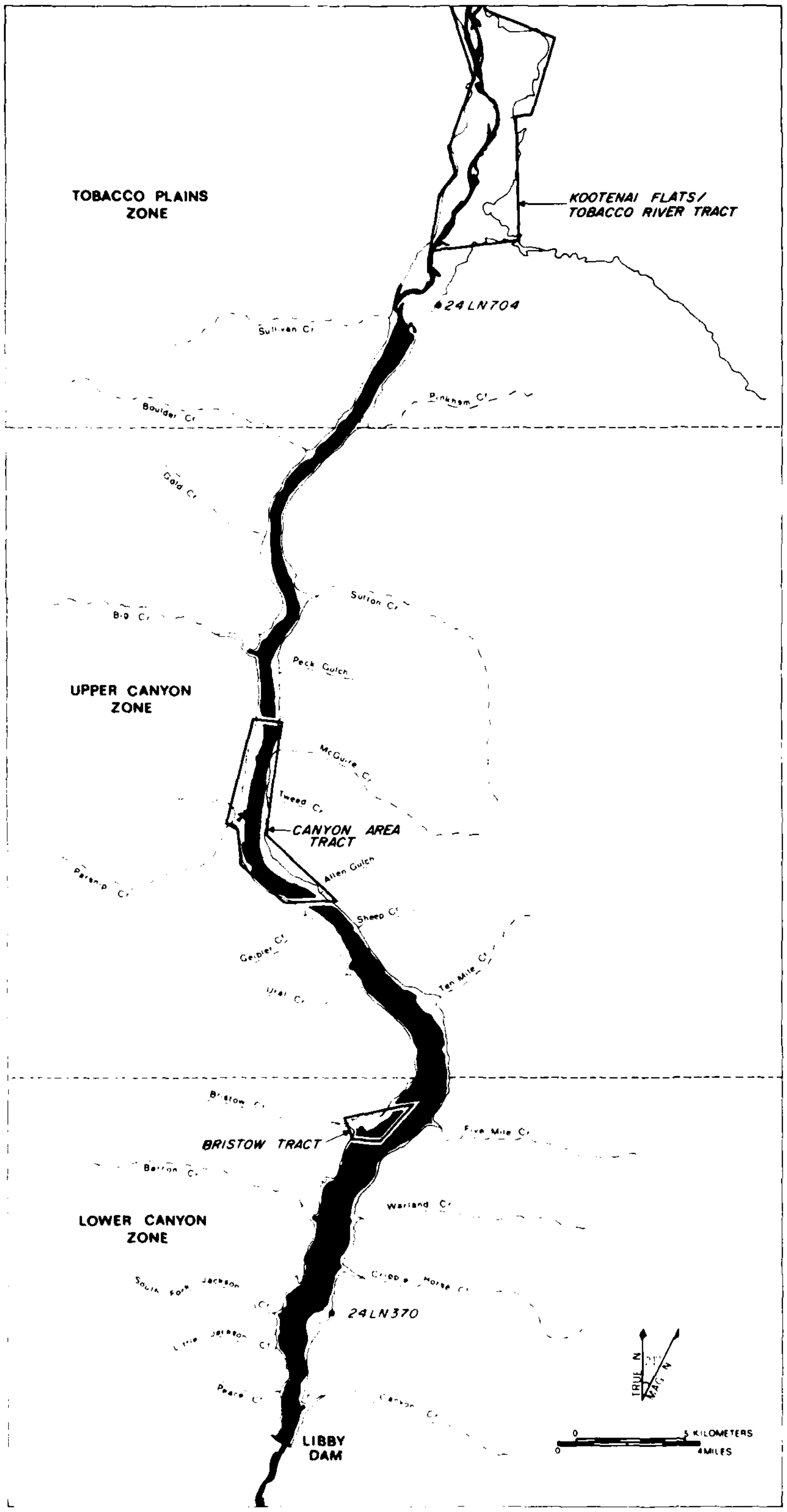

Figure 14-1. Map illustrating approximate location of proposed National Register District tracts and outlier sites.

probability that new and potentially important cultural materials and geologic localities are likely to be exposed during future drawdowns, at which time they could be inventoried. The most practical solution is to include site clusters from each of the three segments of the reservoir--the Tobacco Plains, Upper Canyon, and Lower Canyon zones--as a discontinuous district. At a broad scale, these three groups of sites should represent the major kinds of variability discussed in this report. Environmental and archaeological variability at microlocational and site type scales are represented well within these tracts.

Two other sites are recommended for inclusion within the district as "outliers." These are sites 24LN704 and 24LN370. Both sites exhibit the potential to yield important information that is not available from individual sites in any of the identified site clusters. Site 24LN370 is a large--43,200 m^2--historic site located at the reservoir edge between Cripple Horse and Canyon creeks (see Chapter 10 for a more complete discussion). It contains the remains of log-skidding roads and numerous collapsed structures and facilities associated with the early logging industry. This site has considerable interpretative and educational value and is illustrative of economic patterns that were of major importance to the historical development of this region. Site 24LN704 is a small--875 m^2--low diversity site located in the Tobacco Plains zone, just south of the old Rexford town site. It is judged to be potentially significant for the following reasons: (1) it appears to be a single component--late Middle or Late Prehistoric Period-- site; (2) it may have been occupied once, thus it may contain cultural materials representative of specific activities; (3) it contains the highest density of lithic debitage recovered from a buried context, thus providing a data base for lithic technology and functional studies that are a necessary part of subsistence related investigations; and (4) it does not appear to contain much fire-cracked rock and faunal remains are rare, thus it may be exemplary of one of the debitage-only sites. This type of site is most useful in addressing research questions concerning land use patterns at specific points in time. It also has the potential for providing useful information about the types of activities and time periods represented at larger multicomponent sites.

Approximate (and tentative) tract boundaries for the proposed district, as well as the locations of two individual sites are shown in Figure 14-1. Known cultural resources included within each component of the proposed district are listed in Tables 14-1, 14-2, and 14-3. Individual site locations can be determined by consulting the site location map (Figure 6-1) in Chapter 6. Descriptions of the sites are presented in various tables in the Appendices. Precise site locations are plotted on contour maps housed with the Seattle District, US Army Corps of Engineers.

The existing Libby/Jennings Archaeological District, emcompassing these portions of the LAURD area adjacent to the Kootenai River and below Libby Dam, serves to preserve a sample of lower terrace aboriginal sites. Those kinds of sites are not accessible in the Libby Dam-Lake Koocanusa area. However, the kinds of sites available for investigation in the project area do represent a sample of middle and higher terrace

CHAPTER 14

DIRECTIONS FOR FUTURE INVESTIGATIONS

by
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This chapter provides specific recommendations for future research needs and management actions necessary to mitigate adverse affects to the potentially significant cultural resources in the project area. The contents are similar to Chapter 6 in the "Protection Plan" (Thoms et al. 1984), except that this chapter emphasizes the research aspects, whereas the Protection Plan chapter stressed management recommendations. This chapter begins with a proposal that portions of the project area be nominated to the National Register of Historic Places as a discontinuous district. Several measures considered appropriate for preservation and informed utilization of the nonrenewable cultural resources are discussed in the second section. Next, suggestions are offered regarding how some of the ideas presented in the land use model can be tested. The final section is a general recommendation for archaeologists and land managers concerned with detecting and assessing cultural resources in a montane forest environment.

National Register Eligibility

In Chapter 13 it was argued that cultural resources within the Libby Dam-Lake Koocanusa area are potentially eligible for the National Register for scientific, cultural, and historical values they have yielded or are likely to contain. The values of cultural resources in the project area have been assessed primarily with respect to their potential to yield significant information about settlement and subsistence patterns, especially long-term changes in aboriginal land use systems. To preserve this potential, it is necessary to preserve a sample of sites with differing contents, ages, depositional histories, and settings with respect to a variety of environmental variables (e.g., landform, elevation, distance from permanent water, solar exposure, and foraging space). This is because the study of change in human land use strategies requires comparisons of archaeological remains from locations that differ in their accessibility to various resources. It is argued here that without preservation, it would not be possible to mitigate the adverse effects of the construction project. From a statutory and probably a monetary standpoint preservation is accomplished most readily by nominating the property for the National Register of Historic Places.

A discontinuous National Register district that includes various tracts of land can be designed to represent the range of variation in environmental settings and archaeological remains without including every site in the reservoir. This approach also recognizes the

they exhibit potential to yield important information concerning: (1) long-term trends in hunter-gatherer land use systems; (2) human adaptation at the southern margin of the boreal forest; (3) the origin of sedentism among hunters-gatherers; (4) subsistence-related burning in the Northern Rockies; (5) history and heritage of the Kutenai Indians; and (6) the differences between the ethnographic and archaeological records.

If the aboriginal cultural resources in the project area, or portions thereof, are to be considered as eligible for inclusion on the National Register of Historic Places, it must be demonstrated that they possess integrity, insofar as is necessary to yield the important kinds of information noted in the preceeding paragraph. With regard to integrity of materials, workmanship, feeling, and association, there is no doubt concerning the authenticity or soundness of the artifacts and features that constitute the aboriginal cultural resources. The recovered and/or recorded artifacts and features are, without question, the products of patterned aboriginal behavioral activities in the project area. Integrity of location, design, and setting also can be demonstrated. However, that is not as readily accomplished because in the past those kinds of integrity often have been considered to be synonymous with in situ cultural resources. Many artifacts and features (i.e., sites) in and adjacent to the drawdown zone obviously are not in their exact "natural or original position." To one degree or another, they have been disturbed as a result of forest clearing activities and other processes such as bioturbation and cryoturbation. Nonetheless, it is recognized widely that small, surface, and disturbed sites are often the sources of significant data (Talmage and Chesler 1977). For purposes here, it only need be demonstrated that the artifacts and features remain on the same landforms upon which they were deposited by their users and in general, that the artifacts, features, and sites retain their basic (i.e., "original") spatial relationships to one another. Much of the discussion in Chapters 5, 6, and 11 relates to site condition, an important aspect of integrity of location, design, and setting. From these discussions and a review of Appendix C, Table 5, it should be evident that most of the sites exhibit the kind of integrity necessary to address research questions. Site location information and knowledge of general site structure and content are adequate to yield the appropriate kinds of data.

It is argued here that some sites and site clusters are suited especially well for investigating questions concerning settlement and subsistence, as well as related problems. The most promising site clusters are those that contain sites representative of the various environmental settings, site types, and time periods of occupation/utilization, as well as the range of site structure and assemblage variability. Investigations conducted to date and reported herein indicate that the sites in the Kootenai Flats/Tobacco River area, the Bristow Creek area, and the Parsnip/Tweed creeks area are the most significant ones in terms of National Register criteria. The specific sites and complexes are enumerated, located on a project map, and discussed in the following chapter.

Fort Steele. Kutenai Indians camped in the Kootenai Flats area and there are photographs of Indian teepees near her cabin (Shea 1977:100). Furthermore, a nearby archaeological site (24LN427) yielded historic glass beads that date to a period after 1865. However, there is no definite evidence that sites 24LN427 and 24LN521 were occupied at the same time. Sophie Morigeau is recognized as one of the more important historical figures in the Tobacco Plains area and her cabin site would appear to qualify for National Register eligibility under criterion "2" as well, in that it is a site "associated with the lives of persons significant in our past" (US Government 1981b:56188).

Summary and Discussion of the Lake Koocanusa Data Base According to National Register Criteria

This section focuses on National Register significance criteria as they relate, in general, to sites and site clusters in the project area. In doing so, it sets the stage for Chapter 14, which in part, draws attention to individual sites and groups or clusters of sites considered to be representative of the cultural resources as a whole and especially well suited for future investigations of the research domains outlined earlier in this chapter.

In the preceeding sections, it was argued that several individual historic sites, as well as the aboriginal cultural resources in general and the resulting data base are potentially significant because they appear to meet National Register criteria. These were as follows: (1) criterion "1," sites "that are associated with events that have made a significant contribution to the broad patterns of our history" (US Government 1981b:56189), as in the case of 24LN370 for the early-day logging industry; (2) criterion "2," sites "that are associated with the lives of persons significant in our past" (US Government 1981b:56189), as in the case of 24LN521 for Sophie Morigeau, a midnineteenth century trading post owner and carrier of pack trains; and (3) criterion "4," sites or districts "that have yielded, or may be likely to yield, information important in prehistory or history" (US Government 1981b:56189), as in the cases of the aboriginal sites and their demonstrated potential to contribute important scientific and cultural information.

What remains to be discussed is the criterion of integrity, a quality that is tied intricately to the concept of significance. According to the National Register criteria for evaluation of significance, part of "the quality of significance in American . . . archaeology . . . and culture is present in districts, [and] sites . . . that possess integrity of location, design, setting, materials, workmanship, feeling, and association . . ." (US Government 1981b:56189). It also is evident that significance, as it relates to criterion "4," is not not intrinsic part of the resource. Rather, significance must be defined in terms of the importantness of information the resource has yielded or is likely to yield. With regard to aboriginal cultural resources of the project area, it is argued that

In general, both prehistoric and historic aboriginal cultural resources in the project area have the potential to contribute information about Kutenai history and heritage. Of special interest is the fact that certain aspects of the ethnographic record (Smith 1984) are not compatible with archaeological and ecological data. For example, ethnohistoric accounts indicate that little hunting took place during the winter, whereas ecological data indicate that hunting in the project area would have been most important during winter months. The archaeological record supports the latter contention. By way of another example, the ethnographic record indicates that the harvest from hunting provided about the same proportion of food as did the plant or fish harvest. As has been noted, both archaeological and ecological records argue that hunting probably was more important than plant gathering and fishing combined. How can one explain the differences between the ethnographic and archaeological records? Do they mean that the Kutenai arrived in the project area only recently and thus are not necessarily expected to be like earlier inhabitants of the area? Or, can the differences be explained by historic factors such as the introduction of the horse and gun? Information useful in addressing these and other questions, including those related to Kutenai origins, can be derived from more intensive analyses of data on hand and from more intensive ethnographic research. The cultural materials recovered from the sites provide information useful in addressing these issues. For example, technological studies of lithic tools can determine whether or not the historic aboriginal artifacts differ from prehistoric ones.

The Kutenai Tribe is an ethnic group that played an important role in Northwest history, and continues to play an active role in contemporary life and culture in the region. Consequently, the sites that provide information about Kutenai life and history qualify under criterion "1" of the National Register, in that they are "associated with events that have made a significant contribution to the broad patterns of our history" (US Government 1981b:56188). Through analysis of prehistoric and historic aboriginal cultural materials recovered from sites in the project area (including those excavated by Taylor in the 1960s) subsistence patterns can be characterized and compared over several thousand years. Not only would the results provide information not available from the ethnographic record, but they could be used in elucidating and explaining changes in Native American lifeways brought about by the introduction of horses, guns, and other European factors.

There are two historic sites within or adjacent to the reservoir drawdown zone which also are potentially eligible for the National Register under criterion "1", because they are sites "that are associated with events that have made a significant contribution to the broad patterns of our history" (US Government 1981b:56188). One of these sites is the early twentieth century logging camp (24LN370) located between Cripple Horse and Canyon creeks. The second historic site that is likely to be eligible for the National Register is Sophie's Cabin (24LN521) which was excavated partially by Dee Taylor (1973) during the original salvage project in Libby Reservoir. Sophie Morigeau built a store and trading post at this site in 1883 after her retirement from a career of running pack trains from Walla Walla and Missoula to

To date, the use of fire by hunter-gatherers has been mostly a subject of concern to ethnographers. Archaeologists rarely have asked the questions which their data base is uniquely capable of answering: How long have humans practiced burning in this environment? Have they always used fire in the same ways or were there changes in such practices during the human occupancy of this environment? How does the prehistoric use of fire relate to the general process of subsistence intensification and settlement system change among hunter-gatherers? Most of these questions can not yet be answered adequately, but it is anticipated that they will be of growing importance in years to come. The archaeological record of the study area in particular and the Northern Rockies in general could contribute significant data for investigation of such questions.

These research topics do not exhaust those for which the cultural resources and resulting data base of the project area might offer significant scientific data. They do represent some of the research problems that seem to be especially appropriate to the study area. These problems both demonstrate the potential significance of the area's cultural resources and represent examples of the context in which future archaeological investigations could yield data of scientific significance. A series of specific examples of how data derived from the project area were used to address the research problems has been presented. From these examples and from a reading of this report, it should be apparent that the kinds of data obtainable from project area sites and from comparative research efforts are likely to yield information important in addressing the identified research domains as well as a wide range of other topics.

Cultural Values of Prehistoric and Historic Resources

Lake Koocanusa encompasses areas that were central to two bands of the Kutenai Indians during the nineteenth century. One of these bands was centered in the Tobacco Plains area and the second was located near the mouth of Warland Creek. A third group, the Jennings band, was located at or near the mouth of the Fisher River and may well have used portions of the project area. Descendants of these people are living today in Elmo and Libby, Montana, Bonners Ferry, Idaho, and Cranbrook, British Columbia. Many Kutenai maintain strong interest in their tribal history. As is the case with many Native American and ethnic groups in this country, this interest seems to be growing. Tribal members from the Flathead Reservation have visited the project area in response to reports of vandalism at archaeological sites there. They also have visited Pullman, Washington to see the archaeological collections recovered from the reservoir. The cultural resources of the reservoir comprise a sizable portion of the known aboriginal sites within the traditional homeland of the Kutenai. These resources take on added cultural significance due to the scanty ethnographic and ethnohistoric records that are available for the Kutenai. Much of the available information is presented in the companion volume (Smith 1984) to this report.

Changes through time in site distribution and content appear to be relevant to this problem and worthy of further investigation and consideration. For example, pestles and other nonflaked lithic tools traditionally associated with plant processing are more common at sites occupied during the last 2,000 or 3,000 years than they are at sites occupied between 7,000 and 3,000 years ago. The same can be said about net weights, tools thought to be indicative of fishing. Given that hunting in general was probably more important during the winter and considering that plant and fish resources were probably most important during spring to fall, it may be that the later period inhabitants spent a greater portion of the year in the project area in comparison to their predecessors. Thus, survey and testing data suggest a trend through time toward increased sedentism or at least a reduction in residential mobility.

4. Subsistence-related burning in the Northern Rockies. Evidence from historical records, forest ecology research, and pollen studies in the Northern Rockies suggest that fire was a component of native peoples' subsistence systems. Maintenance of early plant successional stages in this environment is beneficial to large herbivores and also may promote the growth of plant species useful as human food resources. Archaeologists have not considered seriously the question of when the deliberate use of fire for subsistence purposes began in the Northern Rockies and what consequences its use had on settlement and subsistence patterns. Investigations associated with this project addressed these questions in a preliminary way. It was tentatively proposed that the initiation of burning probably coincided with changes in site location and content that were documented with survey data. Examples of these changes include the appearance of net weights in later period assemblages and the fact that late Middle Period sites are horizontally and vertically more widespread than are sites for any other periods. This problem is closely related to those discussed above and is deserving of further investigation and analysis. The use of fire in subsistence has been documented among hunter-gatherers in a wide variety of environmental settings around the world and to some extent in the Northern Rockies (Steward 1955; Lewis 1973, 1977; Barrett and Arno 1982). The role of fire in the coniferous forest of northwest Montana is not well understood, but potentially it is of considerable importance in explaining the archaeological and paleoenvironmental records of this region. Increasingly detailed information about the timing of climatic and vegetational changes is required to determine the relationship between changes in the role of fire and changes in prehistoric subsistence in this ecosystem. Age estimates for most archaeological sites in this region are not sufficiently precise to assess the temporal relationship among charcoal influx in pollen cores, climatically induced vegetation changes, and shifts in the distribution and content of archaeological sites. Consequently, as sites are dated more precisely, the role of subsistence related burning can be defined more clearly.

These observations suggest that hunter-gatherer adaptations to this ecosystem might be equally distinctive. Did these environmental characteristics result in settlement strategies different from those documented in other areas of the boreal forest? Were the aboriginal occupants of this region less mobile or were their annual patterns of aggregation and dispersal similar to those practiced by other boreal hunters? Did they enjoy greater security in subsistence? Did the distinctive resource configurations result in different levels of dependence upon game, plant, and fish resources? These are a few of the questions that arise when considering the scientific potential of archaeological sites in the project area for the comparative study of hunter-gatherer adaptations to different ecosystems.

Crucial to any investigation of adaptive strategies and systems is a thorough understanding of the local environment, including its flora and fauna. Such information seldom comes directly from the archaeological sites, but it does come from geological sites (e.g., road cuts and bog deposits) in the area and a review of the literature. The artifactual evidence (e.g., large numbers of projectile points and thin bifaces) from the sites strongly indicates that adaptive strategies emphasized hunting and that fishing and plant processing were less important. Given the arguments considered here, this is exactly what one would expect, because anadromous fish and abundant plant resources suitable for long-term storage are lacking. Detailed technological and functional studies of the stone tools recovered from the sites are expected to yield more convincing data.

Other survey findings can be made to interface with research concerning seasonality and site function, both of which are aspects of adaptive strategies. For example: (a) the spatial relationship between water sources and sites provides information related to season of occupation; (b) certain kinds of fire-cracked rock might be used as indicators of wet versus dry season occupation; (c) the spatial and temporal distribution of facially ground stone objects and pestles may provide an indication of plant processing; and (d) the distribution of sites with substantial quantities of burned bone and lithic artifacts provides information on hunting related activities.

3. The origin of sedentism among hunter-gatherers. Many explanations for the origin of sedentism among hunter-gatherers emphasize the central importance of spatially and temporally abundant food resources suited for long-term food storage. The absence of salmon and the relatively unproductive nature of plant foods (especially root crops) in this region appear to be characteristics that would preclude the development of sedentism similar to that achieved in lower portions of the Columbia basin. On the other hand, the great diversity and abundance of food sources seem to imply greater potential for reduction in mobility than exists in other areas of the boreal forest.

diversity site indicate that it has been occupied for at least 9,000 years. Demonstrated data categories include the following: (1) a long-term occupational history that should reflect changing environmental conditions and land use patterns, especially those characteristic of the Early Prehistoric and early Middle Prehistoric periods; (2) faunal materials are relatively common in comparison to other sites, thus affording the opportunity to better understand subsistence patterns; and (3) the range of variability in tool types and lithic raw materials is greater than at any site in the reservoir. The site has yielded examples of every tool type found in the project area; thus, it has the potential of yielding important information on artifact assemblages and use of raw material types through time.

Site 24LN1058 is a medium size--8,000 m^2--site. Chronologically diagnostic artifacts from this high diversity site suggest occupation primarily during the latter part of the early Middle Period and the early part of the late Middle Period. Important data categories at this site include: (1) a rock feature associated with a small amount of faunal material and artifacts indicative of hunting related activities, thus providing the opportunity to better understand the assemblage of associated artifacts, features, and faunal remains; (2) cultural deposits representing time periods later than those at 24LN1054, but earlier than those at 24LN704, thus affording study of a time period not otherwise represented in a buried site; and (3) the potential to gather information on intrasite structure and feature function as evidenced by the unusual preservation of one buried feature and the expected occurrence of others.

Data recovery efforts should continue only to the point of diminishing returns, or to that point at which additional work results in the recovery of no significant, new information. It also should be recognized that monitoring efforts might yield other sites that require data recovery.

Monitoring

It is not always practical and cost effective to test deposits at every location where one expects, but does not find, surface evidence for potentially significant cultural resources. One way to increase the cost effectiveness of extensive subsurface examinations is to monitor or observe the sediments as they are being exposed, generally during construction. Monitoring, as used herein, refers to an on-the-ground inspection of a given area to gather new information. It is, in effect, a long-term, on-going survey of areas where newly exposed sediments are likely to contain important cultural resources.

Monitoring should continue until erosion ceases because there is reason to believe new sites and information will be exposed as long as erosion continues. Monitoring should be carried out within the tracts identified as potentially eligible for the National Register as well as in certain other locations that have good potential (as specified in a final research design) for revealing new and especially, different kinds

of sites. New kinds of sites or new information from known sites would include the following: (1) sites with datable organic remains; (2) sites with well preserved faunal assemblages; (3) any Early Prehistoric Period site; (4) well preserved protohistoric or historic aboriginal sites; (5) sites related to nineteenth century fur trading; and (6) geologic localities with well preserved and readily datable and interpretable organic remains, as well as at other localities likely to yield information useful in reconstructing past environmental conditions as they relate to human behavior.

These monitoring recommendations are made primarily because new sites and kinds of information are exposed on an annual basis in the drawdown zone. It is also made because the proposed District tracts contain the known range of site variability and each tract has the potential of yielding older and/or better preserved sites. Only through some kind of monitoring effort can the inventory of cultural resources in the project area be brought to a satisfactory closure. Monitoring should be carried out using methods and techniques similar to those described in the section entitled "Survey Strategies" in Chapter 5. Particular attention should be given to documenting (i.e., photographing, mapping, etc.) the presence of intact features and to the recovery of diagnostic artifacts and organic materials (e.g., bone and charcoal) useful in dating features or sites or in determining site function or seasonality. The preceding statements apply equally to sites already inventoried as well as to those that might be discovered during the monitoring process. Furthermore, data derived from monitoring would be a fundamental part of the "further analyses" aspect of mitigation.

In the event that potentially important cultural resources are discovered, they should be subjected to appropriate kinds of investigative strategies (i.e., beyond the survey and testing level), including, but not limited to those discussed in Chapter 5. If potentially significant geologic (i.e., paleoclimatic) localities are discovered and if it can be demonstrated that they are likely to be important in understanding past human behavior, such localities should be sampled and subjected to appropriate types of analyses, such as sediments, pollen, volcanic ash, and macrofossils. These kinds of analyses are standard aspects of archaeological mitigation efforts. They aid in describing the environment in which people lived and the results are necessary in explaining cultural processes.

In-Place Protection

In-place protection in conjunction with the development of an on-site interpretive center is recommended for 24LN370, the historic logging camp. Recommendations presented here are only general ones. More specific recommendations should be made after a feasibility study is conducted to determine whether or not the general recommendations presented herein are practical measures for preserving site 24LN370.

It is recommended that in-place protection include stabilization of the cutbank within and at least 5 m beyond the known site limits. This is necessary because some structures are currently slumping into the reservoir. The entire site area should be cleared of undergrowth to better expose the various features, which in turn, should be stabilized to prevent further deterioration. Interviews should be conducted with individuals knowledgeable about the functions of the different kinds of structures. Limited surface collections and test excavations also might be necessary to gather enough data to afford adequate interpretations of some of the structures. Because the site area is used as a campground and relic collecting is ongoing, it is recommended that it be enclosed with a high chain-link fence to restrict access.

It has been argued that 24LN521 (Sophie's Cabin) is potentially eligible for inclusion on the National Register. The site was tested extensively (Taylor 1973), but potentially significant information probably remains to be gathered. Two parts of this site--a basement beneath the main house and a nearby root cellar--remain in fair to good condition and are likely to contain artifactual materials useful in reconstructing the roles of Sophie Morigeau and her trading post in the regional socioeconomic system (cf. Taylor 1973:60-65; Chance 1982). It is recommended that consideration be given to protecting this site with a mantle of rip-rap, if access to Kootenai Flats is not to be curtailed by road closure. Failing this, data recovery may be the most appropriate form of mitigation.

Additional Cultural Resource Survey and Testing

During the 1981 and 1982 field seasons the reservoir drawdowns were to 2,350 and 2,342 feet, respectively. At the low elevation of 2,287 feet a very large area of the reservoir would be exposed which was unavailable for intensive survey during the 1981 and 1982 field seasons. Due to the vagaries of predicting conditions of snowfall and climate, it is difficult to anticipate in advance the extent of any particular spring drawdown. Recognizing the possibility that it could be many years before there is a drawdown lower than those of 1981 and 1982, it is suggested that archaeological mitigation not await completion of additional survey of the lower portions of the drawdown zone. The current rate of erosion is too rapid for mitigation to be forestalled for an indefinite period. When and if there is a drawdown that is substantially lower than those of recent years, additional survey should be carried out.

There are a number of questions which the proposed survey project should address. The most obvious, of course, is the extent to which archaeological site distributions and content are accommodated by the picture of aboriginal land use presented here. Alluvial fans graded to the surfaces of lower terraces (T1 through T4) for example, may have a high probability of being locations where archaeological sites are well preserved and less subject to reservoir influences. Sites with good faunal preservation, datable organic material, and discretely stratified

lithic assemblages probably would provide information not already available for the area.

There are other obvious places and types of sites which should be examined. The circular features surrounded by large rocks (possible "tepee rings") reported to be located north of Lake Livermore (David Munsell 1982:personal communication) should be relocated, mapped, and probably tested. There are indications that this site may be a good candidate for a protohistoric or historic Kutenai village. This same vicinity is thought to be the location of an important Kutenai fur-trading post and the Mission of the Sacred Heart of Mary. Another fur-trading post was located in the general vicinity of the mouth of Dodge Creek. These historic sites are all apparently at elevations below those of the 1981 and 1982 drawdowns and would be of considerable historical significance if they are located (Chance 1981, 1982).

As a part of any future surveys, attention should be directed at the identification of lithic raw material sources. It is assumed that most of the noncryptocrystalline (i.e., nonchert) lithics from sites in the reservoir are locally available. If this is so, efforts have been unsuccessful at identifying these sources precisely. Noncryptocrystalline lithics have been found in the local gravels, but few of these are as fine grain as the material used to manufacture the stone tools in this project's collection. Similarly, paleosols and primary volcanic ashes located during survey could prove to be of considerable local and regional importance. Specifically, at occasional sites within the Columbia Plateau and in most montane areas within the Northwest, cultural remains have been located underlying primary Mazama ash. With a single exception, this stratigraphic relationship is lacking in the results of all previous archaeological investigations in the Libby Dam-Lake Koocanusa and LAURD project areas. It is important for understanding land use systems in the study area to resolve whether or not the absence of this association is due to sampling error or if it reflects actual patterning in the "cultural landscape."

Finally, a survey project in the lower elevations of the drawdown zone should include assessment of the impacts of deep basin erosion and deposition. Generally, it is assumed that erosion impacts in deeper portions of reservoirs are not nearly as destructive as those occurring in the upper portions (Lenihan et al. 1981). Deeply inundated archaeological sites in the reservoir probably are being buried under sediments. Consequently, the possibilities of submerged slope failure and wave or current erosion cannot be excluded. There are, in any case, important questions pertaining to reservoir impacts in the lower part of the drawdown zone that should be evaluated during future surveys.

Increasing Public Compliance with Antiquity Laws

The adverse effects of relic collectors on cultural resources of the Lake Koocanusa area are second only to those from operation of the reservoir itself. On certain sites and in some areas of the reservoir,

collector impacts have been more destructive than reservoir-caused erosion. Much of this activity is done on federal lands and in "broad daylight," without apparent fear of apprehension. There are two mutually reinforcing approaches to increasing the public's compliance with existing laws that protect cultural resources on federal lands. The first is enforcement of laws and administrative regulations, and the second is education of the public as to the value of cultural resources and the existence of laws designed to protect them.

Federal land managing agencies have invested substantially in training and maintaining law enforcement personnel in the past few years. In view of the documented importance and fragility of the cultural resources in the project area, managing agencies should make use of these specially trained individuals to assist in enforcing the federal laws that relate to cultural resources. Cultural resources law enforcement in the project area would be easier than in many other areas of public land of equal size. For the most part, there are but three months out of the year when attention would have to be directed at the area--during the spring drawdown. The concentration of most sites in a few areas, along with the visibility of these areas from long distances should enhance the agency's abilities to detect and apprehend violators.

Control of off-road vehicle use through administrative means also holds promise for reducing inadvertent and intentional violation of cultural resources protection laws in the Lake Koocanusa area. It is recommended that study be given to confining vehicle access to public boat ramp areas, and/or marked roads leading to the pool near the boat ramp. All other roads providing access to the reservoir margin should be posted with signs warning that relic collecting on federal lands is illegal and punishable.

Continuation and intensification of agency public education efforts is also recommended. Presentations at meetings of local organizations (e.g., Lion's Club and Junior Chamber of Commerce), newspaper articles, and pamphlets can make the public better aware of the need to preserve sites and of the penalties provided by law. By these means, the public also can be informed of the scientific, cultural and heritage values of cultural resources, thereby creating positive motivations to obey the laws. Agency programs for public interpretation of cultural resources, as outlined in the next subsection also can make a positive contribution to public compliance with the law, particularly when combined with effective enforcement measures.

Potential of Resources for Public Interpretation

It is recommended that consideration be given to the development of cultural resources interpretive exhibits. Cultural resources of the area are amenable to public interpretation and the public has a strong interest in them. Site 24LN370 could be made into an interpretative center. Pathways could be constructed and interpretative signs could be placed at the various structures comprising the logging camp. Displays or exhibits consisting of photographs, artifact casts, dioramas, and

interpretative summaries should be developed and located in places such as Forest Service offices with visitor centers, at the Libby Dam Visitor Center and at local museums. The popular reports prepared as part of this project should be viewed only as a first step toward informing the public about the significant, nonrenewable cultural resources.

A General Recommendation for Surveying in the Northern Rocky Mountains

Much of what has been learned in this project can be applied to understanding and managing cultural resources on federal lands throughout the Northern Rockies. The project area is probably typical of the kinds and density of cultural resources within the region. This statement carries the implication that other forested areas, especially the valley walls of major stream courses, may well have higher site densities than they appear to based on the results of previous surveys. If meaningful surveys are to be performed in the Northern Rocky Mountains and other forested areas, then effective measures must be taken to deal with the low potential for site recognition under natural conditions. Techniques for clearing forest duff in a sample of locations and shallow subsurface testing in these locations are essential if sites are to be identified. Archaeological surveyors also must recognize that sites containing high densities of material often are evidenced by no more than a few flakes or pieces of fire-cracked rock on the surface. More ephemeral sites are proportionately more difficult to locate on the basis of materials visible on the ground surface.

The effectiveness of archaeological surveys will also benefit from applying models of site distribution in a predictive fashion. There are strong correlations between landform, solar exposure, and the occurrence of sites. In general, the material contents and the physiographic patterning of site locations in the Northern Rocky Mountains are beginning to be understood. This knowledge should allow surveyors to focus attention on finding the kinds of cultural resources expected to characterize the land use systems of the highly mobile hunting groups who inhabited the area for thousands of years.

CHAPTER 15

A SUMMARY OF THE ARCHAEOLOGY, ENVIRONMENT, AND LAND USE PATTERNS IN THE MIDDLE KOOTENAI RIVER VALLEY, NORTHWEST MONTANA

by
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This chapter is directed toward summarizing the contents of the preceding 14 chapters. The reader should not think it represents a discussion of the important points in this report; that is done in each chapter. Neither should the reader view this chapter as an abridged version or synthesis of the report; for that is not the intent. What is done here, is merely to list the important elements, findings, and conclusions that are discussed in each chapter. Although a substantial quantity of information is presented, in no way should it be substituted for a reading of individual chapters. Rather, it should serve to direct the reader to chapters of her/his interest.

In what follows, the 14 chapters are summarized sequentially. A modified outline format is used as a means of highlighting major points.

<u>Chapter 1: An Introduction to the 1981-1984 Survey and Testing Project</u>

1. The report documents results of archaeological investigations carried out in northwest Montana along the Kootenai River in Lincoln County. Fieldwork and subsequent analyses were conducted for the US Army Corps of Engineers (ACOE), Seattle District by personnel representing the Center for Northwest Anthropology, Washington State University.

2. In compliance with contractual requirements (Contract Nos. DACW67-81-C-0100 and DACW67-83-M-0522) the following reports were prepared and are on file at the Seattle ACOE office:

    a. a final technical report (two volumes) entitled "Cultural Resources Investigations at Libby Reservoir, Kootenai River Valley, Northwest Montana;" Volume I: "Environment, Archaeology, and Land Use Patterns;" Volume 2: "Kutenai Indian Settlement and Subsistence Patterns;"

    b. an interim management document entitled, "Cultural Resources Protection Plan for the Libby Reservoir, Northwest Montana;"

    c. popular summaries (i.e., brochures for public dissemination) concerning cultural and geological resources of the area;

d. an annual report entitled, "The 1981 Archaeological Survey of the Libby Reservoir, Northwest Montana"; and

e. a plan-of-action entitled, "Libby Dam-Lake Koocanusa Cultural Resources Survey: 1982."

3. Overall project goals were to inventory and assess all observed cultural resources according to criteria established for the National Register of Historic Places.

4. Assessments of significance took place primarily within a research framework that identified important kinds of information that the resources might yield. Identified research domains included:

   a. assessment of site assemblage variability in relation to different environmental settings;

   b. documenting and explaining changes in human land use patterns; and

   c. detecting and explaining differences between the archaeological record on the one hand, and the ethnographic and ethnohistorical records on the other hand.

Chapter 2: History and Summary of Cultural Resources Investigations in the Libby Reservoir Area

1. The earliest investigations of the area were by ethnographers in the late 1800s and early 1900s.

2. On-the-ground fieldwork began in 1950 when six archaeological sites were discovered during a Smithsonian Institution survey designed to document sites that would be affected by the construction of Libby Dam and its reservoir.

3. Another 24 sites were discovered and 11 were test excavated in conjunction with the National Park Service's 1966 archaeological salvage project for the soon-to-be constructed dam.

4. In response to the 1975 discovery of numerous sites in the newly exposed drawdown zone, the Corps of Engineers funded a reconnaissance level survey that resulted in the discovery of 34 new sites and the prediction that there could be 400 sites within and adjacent to the drawdown zone.

5. Subsequently, several small scale survey projects were conducted and by 1980 some 90 sites were documented in the US portion of Lake Koocanusa.

6. Other survey and testing projects were carried out in the Canadian portion of Lake Koocanusa and below Libby Dam, where numerous sites were discovered and tested.

7. Results of previous investigations indicated that the project area may have been inhabited before 4,500 years ago, but it was not until about 3,500 years ago that groups of people began to use the area on a regular basis. Subsistence was based mainly on hunting local animals and gathering wild plants, but fishing became important during the Late Prehistoric Period. By the Historic Period, bison hunting east of the mountains had become an integral part of the Native American lifeway.

8. There was little to indicate that the valley walls, high above the Kootenai River, or the valley bottoms, were occupied extensively beginning at least 7,000 years ago. Although much had been learned, the picture of past human lifeways in the middle Kootenai River valley remained incomplete, due to the following factors:

   a. sites were difficult to locate in the montane coniferous forest environment and once found some were considered to be so ephemeral as to be of little importance;

   b. excavated and dated sites tended to be the younger, larger, and "richer" sites buried in the flood plain adjacent to the Kootenai River;

   c. small, restricted survey projects often fail to provide an adequate sample of a large area;

   d. a culture history focus, with an emphasis on comparing the middle Kootenai River to the "better known" Plains and Plateau culture areas, hampered efforts to approach the Kootenai area as environmentally distinctive, yet similar to boreal forest ecosystems; and

   f. a paucity of theoretical and anthropological perspectives thwarted archaeological efforts to place local cultural resources in the context of human behavorial systems.

Chapter 3: The Montane Coniferous Forest Ecosystem of Northwest Montana and Vicinity

1. During the Full-Glacial Period--ca. 22,000-18,000 years ago--the project area was covered by a southward advancing ice sheet over 4,000 feet thick.

2. By the middle of the Late-Glacial Period--ca. 14,000-11,500 years ago--most of the area was ice free and there were many lakes; a large one in the project area lasted until about 11,500 B.P. Although pioneer vegetation was established by about 12,200 years ago and game animals probably were present, there is a lack of clear, direct evidence for human occupation during the Late-Glacial Period.

3. The Kootenai River downcut through glacial deposits and the present landscape took shape during the warmer Periglacial Period-- ca. 11,500-8,500 years ago. Albeit tentative, there is now evidence for human utilization toward the end of this period, during a time when relatively open forests dominated the landscape.

4. Warmer and drier conditions continued through the early part of the Interglacial Period (i.e., the last 8,500 years). Extensive human utilization of the area probably began at least 6,000 or 7,000 years ago. By about 4,000 years ago climatic conditions became cooler and wetter and the more mesic, spruce/fir forests developed. The region's vegetation appears to have changed little during the last 2,800 years or so.

5. Modern vegetation in the region ranges from dense, closed canopy spruce/fir forests to park-like stands of ponderosa pine. Precipitation ranges from 15 to 25 inches per year and there are about 80 days in the frost-free season.

6. For analytical purposes, the project area is divided into three physiographic zones:

    a. the northern or Tobacco Plains zone, characterized by a wide valley and parkland vegetation;

    b. the central or Upper Canyon zone, with a narrow, steep-walled valley and dense forest vegetation; and

    c. the southern or Lower Canyon zone, with its large tributary streams and distinctive terrace system and where patches of open canopy forest are mixed with the closed canopy forest.

7. Lightning and human-caused fires have been important aspects of local vegetation patterns and forest succession. Most ungulates, including deer, elk, moose, and mountain sheep, benefit from the increased quality and abundance of forage that is available from forests in early successional stages.

8. Because browse plants at higher elevations become inaccessible under heavy snow cover, most large game animals, especially ungulates, move to lower valleys in winter and confine their daily activities to small areas. With winter yarding, the ungulates become the most predictable and abundant food resource for human beings.

9. Anadromous fish (salmon) do not occur in the area and fish production is much lower than in areas to the north and west. Although probably never a long-term, primary food source for hunter-gatherers of the area, fish (e.g., trout, whitefish, burbot, and chub) were relatively abundant and accessible during the spawning seasons, particularly the late spring and early summer.

10. Due to the short growing season, the kinds of plant resources used as food by hunter-gatherers probably were never abundant, but they provided a necessary supplement to the diet. However, many kinds of important plant resources (e.g., balsamroot, camas, bitterroot, chokecherry, serviceberry, and huckleberry) are present and are comparatively abundant in recently burned areas.

Chapter 4: Prehistoric Land Use in the Montane Coniferous Forest

1. Boreal forest ecosystems are more characteristic of the project area than are either grasslands or steppes. In boreal forests, primary biomass (vegetation) is high, secondary biomass (animals) is comparatively low, vegetation is a fine-grain mosaic, game resources are often dispersed, and there is a high degree of climatic and biotic variance over both long and short time periods.

2. Compared to other boreal ecosystems, the middle Kootenai River valley has the following distinctive characteristics:

    a. it is under the influence of the mild maritime climate;

    b. the diversity of large game animals is unusually high;

    c. the annual ranges of game animals are smaller in size, especially during the winter;

    d. edible plant resources are more abundant; and

    e. the montane setting is such that plant and animal resources can be exploited readily at different elevations at different times of the year.

3. The model developed for long-term human adaptations in the middle Kootenai River valley includes the following expectations:

    a. an early settlement pattern characterized by high residential mobility;

    b. an early subsistence pattern characterized by big game hunting, with very minor fishing and plant collecting;

    c. change in settlement and subsistence patterns induced by an imbalance in the human population-food resources relationship brought about by the complex interplay of environmental change, technological innovations, and population densities;

    d. later period subsistence intensification (as a process of change) involves enhancement of resource productivity by maintaining early stages of forest succession through deliberate burning and broadening the resource mix to include

items more costly in terms of search, pursuit, and processing time; and

e. later period settlement patterns characterized by lower residential mobility and centrally located base camps.

4. According to the model, the archaeological record is expected to have the following characteristics:

   a. most sites, especially the older ones, should be related to hunting in terms of assemblage content and environmental setting;

   b. older sites should reflect primarily short-term, winter occupations;

   c. younger sites should be indicative of more year-round occupation than older sites;

   d. younger residential sites should be found near the river or in other places that facilatate access to fish and plant resources as well as to game animals.

Chapter 5: Investigative Strategies

1. Most of the 1981 field season (March-June) was devoted to survey work, while testing activities dominated the 1982 field season (February-June).

2. Land surfaces in the denuded drawdown zone (between 2,342 and 2,459 feet elevation), and a 30 m vegetated zone around the reservoir were surveyed using the transect method. Individual surveyors walked a zig-zag pattern within 20-30 m wide contiguous transects. Specialized survey techniques included:

   a. troweling away postreservoir sediments to expose the prereservoir surface, thereby enhancing the chance of detecting cultural materials;

   b. close scrutiny of tree tip-ups and other places where the subsurface was exposed;

   c. resurvey of selected areas where sites were expected but not found; and

   d. marking all site locations with a semipermanent, labeled datum stake to facilitate relocation.

3. All known sites were classified according to multitiered criteria, including location within reservoir zones, type of landform, distance from permanent water, and site assemblage diversity. An

effort was made to select and test each type of site recognized in the classification scheme. Specialized testing techniques included:

a. shovel skimming near-surface deposits to recover artifacts obscured by postreservoir sediments;

b. focusing recovery efforts on fire-cracked rock features and their immediate vicinities;

c. use of multiple, small size subsurface test units to assess the general nature and distribution of buried cultural deposits; and

d. formalization and operationalization (a decision flowchart) of a systematically judgmental testing approach designed to recover "representative" artifact/feature samples from selected sites.

4. Testing activities consisted of the following:

a. recovery of grab samples (i.e., site provenience only) from 15 sites;

b. recovery of point provenience artifact samples from 49 sites;

c. partial grid unit and dog leash collections made at 15 sites;

d. total surface collections (excepting fire-cracked rock) made at 47 sites;

e. excavation of exploratory probes and small test units at 43 sites; and

f. excavation of 1 x 1 m or larger test pits at 14 sites.

5. Preliminary artifact processing was done in the field in 1981 and 1982. More detailed analyses were carried out at Washington State University during that time and continued into 1984.

6. Data generated as a result of the project are considered to adequately represent the observed variability. In fact, the project yielded a heretofore unparalleled data base for understanding land use systems in the Northern Rocky Mountains. However, because there are conditions that affect interpretations adversely, some cautionary notes are necessary:

a. slow rates of deposition, acidic soils, bioturbation, and cryoturbation lead to poor preservation conditions and stratigraphic mixing;

b. logging, clearcutting, and razing of historic structures, as well as extensive erosion related to reservoir operation are other processes that have altered the archaeological record;

c. relic collectors and off-road vehicle enthusiasts have removed and/or destroyed cultural materials throughout the reservoir;

d. land surfaces below 2,342 feet elevation and above 2,460 feet remain to be surveyed systematically; and

e. the systematically judgmental testing strategy employed here renders certain statistical approaches (e.g., those that demand random samples) to the data difficult, at best.

Chapter 6: The General Nature and Distribution of Cultural Resources

1. As a result of more than 30 years of fieldwork in the Libby Dam-Lake Koocanusa project area, a total of 249 sites and 46 isolated artifact finds have been recorded.

2. Site distributions in terms of selected locational characteristics are as follows:

   a. the Lower Canyon zone, with 31.6 percent of the area (total of ca. 17,400 acres), has 27.7 percent of the known sites;

   b. the Upper Canyon zone, with 32.2 percent of the area, has 14.9 percent of the known sites;

   c. the Tobacco Plains zone, with 36.2 percent of the area, has 57.3 percent of the known sites;

   d. the ratio of the number of sites on the east versus west side of the river is 2.7:1;

   e. the low terraces (T1-T4) contain 33.3 percent of the 249 sites, the middle terraces (T5 and T6) have 43 percent, and the high terraces (T7 and above) have 23.7 percent of the recorded sites;

   f. with regard to solar exposures, 45.4 percent of the known sites have good exposures, 41.4 percent have moderate exposures, and only 13.2 percent have poor solar exposures; and

   g. distance between sites and permanent water sources are grouped into three categories; 17.3 percent of the sites are near (within 99 m) permanent water, 25.3 percent are at a moderate (100-299 m) distance, and 57.4 percent are classed as being far (more than 300 m) from permanent water.

3. Selected site characteristics according to artifact and feature assemblages are as follows:

e. inventory-level survey work should be carried out on all land surfaces between 2,342 and 2,287 feet elevation as soon as the reservoir is drawn down to its minimum level; and

f. extensive relic collection and off-road vehicle use in the drawdown zone should be curtailed by: (1) utilizing the specially trained forest service personnel to enforce federal antiquity laws; (2) confining vehicle access to a few areas, and (3) intensifying efforts to educate the public concerning the need to preserve nonrenewable cultural resources.

4. The material contents and physiographic patterning of sites in the Northern Rocky Mountains are beginning to be understood. This knowledge should allow surveyors to focus attention on finding the kinds of cultural resources expected to characterize the land use systems of the highly mobile hunting groups who inhabited the region for thousands of years.

c. the role of Sophie Morigeau as an important person in local history.

Chaper 14: Directions for Future Investigations

1. Establishment of a National Register District is recommended as the most effective way to preserve the project area's potential to yield significant information. The proposed district is made up of three tracts of land, one in each of the reservoir zones and two outlier sites.

2. The existing "Libby/Jennings Archaeological District" (located immediately below Libby Dam) serves to preserve a sample of valley bottom sites and the proposed "Middle Kootenai River Valley Archaeological District" would protect a suite of valley wall sites. Recognition that these two districts contain different manifestations of related human behavorial activities, tends to encourage future archaeological investigations (including the proposed mitigation effort) that are nonduplicative and comprehensive at a larger geographic scale.

3. Investigations already conducted in the project area are not considered adequate for mitigation purposes. Additional investigations undertaken to mitigate adverse effects of the Libby Dam construction project should take place within the framework of a final research design and include the following elements:

   a. further analyses of data generated as a result of this project, including those directed toward: (1) intrasite structure and variability, (2) intersite assemblage comparisons, (3) site location variability, (4) past environmental conditions, (5) environmental and cultural comparisons with other local data bases, (6) lithic wear pattern studies, and (7) sourcing lithic raw materials;

   b. data recovery efforts at three sites (24LN704, 24LN1054, and 24LN1058) directed toward: (1) exposing large subsurface areas of each site, (2) excavation of features, especially those likely to yield organic remains, and (3) recovery of large samples of artifacts representative of different activities and time periods;

   c. monitoring--on-the-ground inspection--to discover new and different sites in each of the district tracts, should be carried out during future drawdowns and until the erosion process is stabilized;

   d. in-place protection should be implemented at the historic logging camp (24LN370) and for the basement and root cellar at Sophie Morigeau's cabin (24LN521);

8. Differences between the archaeological and ethnographic records probably are due directly or indirectly to European influences.

9. In the companion volume (Smith 1984) to this report, a dynamic series of land use patterns (A.D. 1650 to 1900) is postulated for the Kutenai Indians. The basic phases were:

    a. pre-equine Kutenai lived in small, widely dispersed settlements and relied primarily on game animals, plant resources, and fish obtained locally;

    b. acquisition of horses and firearms offered the technological capability to overhunt the Kootenai River valley and to travel to the Plains in pursuit of bison. Kutenai involvement in the worldwide fur industry of the early 1800s, provided the incentive to do so; and

    c. with the disappearance of bison in the late nineteenth century Kutenai people were forced to rely on local resources and with the depletion of game animals, fish and plants became far more important food resources.

Chapter 13: The Significance and Potential of Identified Cultural Resources at Libby Reservoir

1. Application of scientific significance criteria is accomplished effectively through discussion of important research problems. In terms of criteria established for the National Register of Historic Places, sites in the project area have yielded or are likely to yield important prehistoric or historic information related to these topics:

    a. long-term trends in hunter-gatherer land use system;

    b. human adaptation at the southern margin of the boreal forest;

    c. subsistence related forest burning in the Northern Rockies;

    d. the origin of sedentism among hunter-gatherers; and

    e. explaining incongruities in the archaeological and ethnographic records.

2. Cultural values also are important in establishing significance in terms of the National Register of Historic Places. Of particular note are the sites that are associated with important events or people. Sites in the project area have yielded or are likely to yield important information concerning:

    a. the history and heritage of the Kutenai people;

    b. the role of the logging industry in the region; and

component sites are evenly distributed in terms of terrace setting, but not to the extent as during the late Middle Period. Late Prehistoric "single component" sites are larger and have more fire-cracked rock features than do other "single component" sites. Compared to other periods, there are proportionately fewer high diversity and more low diversity sites. There is also a tendency for the low diversity sites to be sequestered on the landscape. Together, these data indicate a continuation in the trend toward a logistically oriented "collector" system with the following land use patterns:

a. extensive portions of the project area were utilized intensively, even more so than during the preceding period;

b. dry season occupation occurred, as did winter occupation, probably by comparatively large groups of people relying predominately on hunting, but fishing and plant processing were more important;

c. residential camps were comparatively few in number, but occupied by larger groups; reliance on task-specific groups to procure foods was most evident at this time; and

d. utilization of valley wall and bottom resources continued, but residential sites tended to be located in areas adjacent to major water courses.

5. A climate-caused reduction in the abundance of browse plants and grasses may partially explain the apparent shift through time in settlement locations from the Lower Canyon to the Tobacco Plains.

6. If controlled burning was a regular part of the intensification pattern in the aboriginal land use system, then it may have been in response to an increased forest cover and/or increasing human population density, probably during the latter part of the late Middle Period.

7. Land use systems described for the Kutenai Indians are unlike those inferred from the archeological record:

a. large "villages" reported in or inferred from the ethnographic record have not been documented archaeologically;

b. the reported importance of bison is not documented archaeologically;

c. there is nothing in the archaeological record to indicate that fishing and/or plant processing were as important as hunting; and

d. long-term occupation of "villages" and reliance on stored food is contradicted by the absence of dense midden deposits, semipermanent dwellings, storage facilities, and cemeteries.

of the components have good solar exposures. Only 16.1 percent are within 100 m of a permanent water source. Only a few of the sites are situated on low terraces. Fifteen of the 26 sites (61.5%) with an Early/early Middle component are classed as high diversity. Collectively, these and other data are interpreted as representing a "forager" system with the following land use patterns:

a. initially, utilization of the area was sporadic, but by the end of the early Middle Period, it was extensive, if not intensive;

b. winter occupation, probably by highly mobile hunting groups, dominated utilization of the area;

c. residential mobility was high and there were few special purpose sites; and

d. subsistence resources were procured primarily from valley wall as opposed to valley bottom locations.

3. The 33 sites with a late Middle Period component are more common and more evenly distributed in terms of terrace setting than are those representing previous periods. Comparatively fewer sites are found in the Lower Canyon and more are on the Tobacco Plains. Less than half (45.4%) of the sites with a late Middle component have a good solar exposure. The percentage of sites with poor solar exposures is almost twice that of the preceding periods and comparatively more sites are near permanent water. The proportion of high diversity sites (62.1%) is about the same as it was for sites with earlier components, but single component sites are three times as common during the late Middle Period. These characteristics suggest a late Middle Period shift toward a "collector" system with the following land use patterns:

a. extensive and intensive utilization occurred during this period;

b. year-round or at least wet (winter) and dry (summer) season occupation took place, probably by hunting groups who were beginning to use small game and aquatic resources more extensively;

c. residential mobility decreased and there was an increased reliance on task-specific groups to procure food resources (i.e., producers begin to move the resource to the consummers, as opposed to moving the consumers to the resources); and

d. both valley wall and valley bottom resources were used extensively, as judged by site locations.

4. The 34 Late Prehistoric/Historic components (from 31 sites) are the most common. Sites with poor solar exposures are twice as common as during the preceding period. The Late Prehistoric/Historic

solar exposures. This indicates that prolonged daily solar exposure was an important criteria in selecting a campsite. Such behavior would be most advantageous during the cold/wet season, namely winter and early spring; and

b. more than half the sites, including 44 percent of the high diversity sample and 65 percent of the low diversity sample, are more than 300 m from a permanent water source. Sites near (e.g., within 100 m) permanent water could be occupied during any part of the year for any amount of time. Those far (e.g., more than 300 m) from a permanent water source probably were occupied either for very brief periods of time or when water was available from a nearby intermittent source, namely during the winter and early spring (from melting snow).

4. The fact that 52.9 percent of the high diversity sites are in the Lower Canyon zone where winter yarding is common, supports the contention of more intensive utilization of high productivity (game animal) areas. Conversely, the fact that 58.1 percent of the low diversity sites are in the Tobacco Plains zone where yarding is much less common, lends credence to the hypothesis that lower productivity areas are utilized extensively, as opposed to intensively.

5. Available data illustrate that the Tobacco Plains zone was occupied during the Historic Period by Native American more intensively than were other zones. This is probably because the Upper Kutenai and other groups who utilized the area were equestrian peoples and they required considerable foraging space for their horses.

6. Aboriginal sites tend to be clustered as opposed to scattered across the landscape, but sites do occur in relative isolation. Most site clusters are found at locations with good solar exposures and in proximity to good foraging areas, including large south facing slopes, expansive terraces, and low relief areas like the Tobacco Plains. Nearness to a permanent water source does not seem to be an important factor.

Chapter 12: Prehistoric Land Use in the Middle Kootenai Valley

1. Projectile points are used as period markers or indicators of the time periods when the sites yielding the artifacts might have been occupied. A total of 58 sites, including 10 tested in the 1960s, yielded projectile points or historic aboriginal artifacts. Of these, 30 are considered to be single component sites because they yielded projectile points representative of only one time period.

2. There are 26 sites representing 31 Early/early Middle components. They are best represented in the Lower Canyon and poorly represented on the Tobacco Plains. Slightly more than half (51.6%)

farm/ranchsteads, logging camps, and log flumes, none of which appear to be over 100 years old.

4. The overall distribution of historic sites in the region, including the project area, documents a shift in land use patterns, from an initial and rather restricted focus on the Kootenai River and valley bottom to one that also encompassed the higher terraces and valley walls.

5. Recovered Euroamerican artifacts and recorded sites in the project area are illustrative of later patterns--farming, ranching, and logging--in regional history, but not of the earlier period when fur-trading and gold mining constituted the major subsistence activities. Artifactual evidence for the early Historic Period is limited to the glass beads and copper ornaments from several Native American sites. However, historical documents and the results of other investigations demonstrate that fur-trading posts, an early mission, and evidence of early-day gold mining are present within the confines of Lake Koocanusa, but remained innundated during the course of the 1981 and 1982 fieldwork.

Chapter 11: Site Analysis and Selected Descriptions

1. Aboriginal sites yielding six or fewer artifact types (out of a possible 14), including fire-cracked rock, flaked lithic debitage, and faunal remains, are considered to be "low diversity" sites. This is the most common site type in the project area, representing 82.6 percent (161 sites) of the 195 sites with enough information for classification. Low diversity sites tend to be small in size, and tools, when present, tend to be either projectile points or thin edge modified flakes. However, nonflaked lithics and thick, flaked tools occur regularly. Single component sites are well represented and most of them are Late Prehistoric sites.

2. High diversity sites are defined by the presence of seven or more artifact types. These 34 sites represent only 17.3 percent of the classified aboriginal sites, but they yielded over 80 percent of the recovered artifacts. Although high diversity sites tend to be those with large numbers of artifacts, there is enough divergence from that tendency to indicate that sample size alone probably does not account for a significant number of those sites. Slightly over half of the high diversity sites are multicomponent, in that they yielded projectile point types indicative of more than one time period.

3. Extensive, if not intensive, winter use of this part of the middle Kootenai River valley is suggested by at least two site locational factors:

   a. over 85 percent of all the sites have good (south or southwest) or moderate (west, northwest, east, or southeast)

including exotic shell, fish, bird, elk, deer, probably bear, and bison. The medium size category dominates the late assemblage and large mammalian remains outnumber small ones. To some degree, these data support the subsistence intensification hypothesis.

5. As was the case for lithics, the faunal remains from this project can be said to constitute a valley wall assemblage and those recovered from previous projects in the immediate vicinity represent a valley bottom assemblage. Some important differences and similarities are as follows:

   a. although both assemblages are dominated by deer, the valley bottom sample is overwhelmingly deer;

   b. the valley wall sample contains a more even distribution of ungulates, and includes caribou and bison(?), neither of which are represented in the valley bottom assemblage; and

   c. the valley bottom sample contains several species--beaver, lynx, fox, and bear--that are either unrepresented in the valley wall sample or were recovered from a questionable context.

6. These data also appear to support the intensification hypothesis, if the valley bottom assemblage is indeed younger. The overwhelming dominance of deer suggests extraordinarily intensified exploitation, and small animals and fish, as well as bear, sheep, and elk were also exploited during the later periods.

Chapter 10: Historic Sites and Artifacts

1. Historic artifacts--those judged to derive mainly from Euroamerican utilization and occupation of the region--were recorded at 78 (31.3%) of the 249 sites in the project area. With the notable exceptions of historic aboriginal sites and historic structure (Euroamerican) sites, most recorded historic artifacts are indicative of comparatively recent trash dumping and the haphazard discarding of unwanted or used items.

2. The historic artifact collection includes 624 items from 31 sites and two isolated finds. Examples include tin cans, nails, cartridges, bullets, coins, buttons, ceramics, glass containers, window glass, and farm machinery parts. Also represented are probable Native American artifacts including glass trade beads from two sites and a copper ornament from one site.

3. The drawdown zone includes a variety of historic sites, but all standing structures were razed during dam construction. Euroamerican sites are classified either as debris sites (trash scatters) or structure sites, including some standing structures along the reservoir margin. Structure sites include the remains of

tools per site. This pattern would be more characteristic of short-term residential camps, than either task-specific camps or long-term base camps.

Chapter 9: Faunal Analysis

1. Even though preservation conditions are poor, recovered faunal remains include 4,360 bone and shell items from 75 sites and isolated finds.

2. The collection is divided into four samples, each defined on the basis of specificity of identification:

   a. nonmammalian remains (167 items) represent 3.8 percent of the faunal collection; those recovered from a probable archaeological context include river mussel shell fragments from two sites, abalone shell fragments from one site, a shell pendent (Isolated Artifact No. 34), burned bird bones from two sites, and burned fish bones from one site;

   b. mammalian remains, identified at least to family level (239 items), constitute 5.5 percent of the sample; those recovered from an archaeological context include rabbit from several sites, dog from one site, deer from 13 sites, mountain sheep from three sites, elk from three sites, possibly caribou from one site, bear(?) from another site, and bison(?) from one site. Horse, cow, and domestic sheep remains were recovered from numerous sites, most of which were clearly historic Euroamerican;

   c. faunal remains identified to size class (2,768 fragments) represent most of the sample (63.5%). Most of those are pieces of burned bone from medium size (e.g., deer) animals. Several large size (e.g., elk) and small size (e.g., beaver) burned bone fragments also were recovered in archaeological contexts; and

   d. most of the unidentified remains (1,186 items or 27.2% of the sample) also were burned; they too were recovered in archaeological contexts.

3. The shell pendent, three pieces of abalone shell, and three antler tine tools constitute the only identified "artifacts" in the faunal collection.

4. Although data are scant and clearly biased by poor preservation, they indicate that sites with Early/early Middle Period projectile points are dominated by medium size mammals (probably deer) and small size mammal remains outnumber large size remains. Sites with late Middle/Late Prehistoric projectile points or Historic Period aboriginal artifacts are characterized by a variety of taxa,

b. projectile points and thin bifaces (i.e., hunting related tools) account for 30 percent of the recovered tools, suggesting that hunting may have been the most important subsistence activity;

c. net weights and ground stone artifacts are represented in very low frequencies (3.4% of all lithic tools), suggesting comparatively minor roles for fishing and plant processing as subsistence activities; and

d. a wide range of tool types are represented in reasonably high frequencies at sites with large numbers of tools and several tool types often are represented at sites with a small number of tools in the assemblage; this suggests that residential sites, where a wide range of activities were conducted, are common in the project area.

8. Lithic artifacts recovered during this project are from the higher terraces (T4-T9), whereas those recovered during previous projects are primarily from the lower terraces (T1-T3). Artifacts from the higher terraces, in effect, constitute a valley wall assemblage and those from the lower terraces can be said to represent a valley bottom assemblage. Important differences and similarities between these two assemblages include:

   a. projectile points indicative of later time periods are best represented in the valley bottom assemblage and those indicative of earlier time periods are best represented by the valley wall assemblage;

   b. both assemblages are dominated by expediency tools and secondarily by projectile points, thin bifaces (i.e., knives), and other hunting related tools such as end scrapers;

   c. thin bifaces and projectile points are proportionately more common in the valley bottom assemblage, as are net weights;

   d. heavier tools like thick bifaces, edge modified cobbles, hammerstones, and edge-ground cobbles are much more common in the valley wall assemblage;

   e. chert tools and debitage are far more common in the valley bottom assemblage;

   f. both assemblages appear to represent a core/flake industry, but a bifacial core/tool industry and core reduction in general are best represented by the valley wall assemblage; and

   g. comparatively, a wide range of activities--hunting/processing, plant processing, lithic tool manufacturing/reconditioning, some wood working, and fishing--is better represented by the valley wall assemblage which includes significantly fewer

Chapter 8: Lithic Artifacts: Form and Function

1. The morphological/technological analysis focused on operationalizing a hierarchical classification scheme that yielded 72 classes and subclasses encompassing the 32,201 flaked and nonflaked lithic artifacts.

2. Overall, the collection of flaked lithic artifacts best represents a core/flake industry (i.e., where flakes, but not cores, are tool blanks), but there are enough bifaces of various sizes to indicate that a bifacial core/tool industry (i.e., where flakes and cores are blanks) also functioned in the project area.

3. Most raw materials used to manufacture flaked tools are of local origin, including mudstones that account for 66.4 percent of the debitage and quartzites representing 24.5 percent of the debitage. Chert (9.1% of the debitage) and the very few pieces of obsidian are nonlocal materials.

4. Mudstones account for the majority of all cores and flaked lithic tools. Quartzites are best represented among the large, heavy tools; chert accounts for a higher percentage of projectile points and thin bifaces than for any other tools.

5. A total of 144 artifacts are classified as nonflaked lithic tools. These are divided into four subcategories:

    a. battered stone (e.g., hammerstones and anvils), 99 tools or 68.8 percent of all nonflaked lithic tools;

    b. ground stone (e.g., manos, metates, "edge-ground cobbles"), 34 tools or 23.6 percent;

    c. pecked stone (e.g., pestles, mauls, grooved abraiders), 9 tools or 6.2 percent; and

    d. incised stone, 2 items or 1.4 percent of the nonflaked lithics.

6. Fire-cracked rock is the most common artifact in the project area. Results of preliminary experiments suggest it may be possible to distinguish between fire-cracked rock produced during stone boiling and that produced in hearths or ovens. That distinction may have important implications for the study of land use patterns.

7. Important findings as they relate to the land use model include:

    a. expediency tools--edge modified flakes and cobbles--dominate the overall assemblage, suggesting use of the area by a mobile population;

b. Mount St. Helens, set J tephra, ca. 11,800-11,200 years old; or

c. Glacier Peak G tephra, ca. 11,200 years old.

3. Between about 15,000 and 11,800 years ago a series of kame, outwash, and lake terraces (T8-T14) formed at or above what is now the maximum elevation (ca. 2,460 feet amsl) of Lake Koocanusa.

4. By 11,500 years ago the Cordilleran ice sheet and most of the glacial lakes had disappeared from the area. The Kootenai River began to downcut through hundreds of feet of glacial, fluvial, and lacustrine sediments, leaving at least six (T7-T2) reasonably well defined terraces. The modern terrace (T1) began to form sometime after 8,200 years ago.

5. While the terraces were forming, many fans and deltas were deposited, especially at the mouths of tributary streams; landslides also occurred at various places on the landscape.

6. Beginning over 8,000 years ago and continuing for 6,000 years, aeolian sands were deposited as dunes in the north and as sheet formations elsewhere.

7. In an attempt to correlate artifact assemblages from widely separated sites, a series of six stratigraphic analytical units were defined. One unit (LKDI) represented postreservoir deposits; another unit (LKDII) encompassed sediments disturbed by processes related to the reservoir; early and late post-Mazama units (PMI and PMII) were identified, in part, by the presence of Mazama glass shards; early and late pre-Mazama units (AMI and AMII) were defined, in part, by the absence of Mazama glass shards.

9. Geological data provide an indication that human use of the landscape in the project area began no later than 9,000 or 8,000 years ago. This is based primarily on the occurrence of cultural materials in and below the AMII unit.

10. Widespread human utilization of the project area probably occurred after complete abandonment of all terraces (except T1) by the Kootenai River (ca. 8,200 years ago) and during later periods of aeolian deposition. The dynamic nature of the late Pleistocene/early Holocene landscape may have been such as to limit and/or preclude occupation of the landscape in the project area. It is likely that evidence of ephemeral or even more intensive occupations would have been destroyed or so disturbed by natural land forming processes as to render the cultural manifestations unrecognizable.

11. It is emphasized that land surfaces above the highest Kootenai River terraces have not been surveyed systematically. If late Pleistocene/early Holocene sites exist in the area, they are likely to be found above the maximum elevation of Lake Koocanusa.

arrow points, 51; (f) dart points, 154; (g) thin, edge modified flakes, 491; (h) thick, edge modified flakes, 151; (i) nonflaked lithics or ground, pecked, incised, and battered stone tools, 144; and (j) notched pebbles or net weights, 10.

7. The 249 sites were classified according to the kinds of artifacts and features observed and/or collected. Recognized site types and their respective frequencies are as follows:

   a. high diversity (aboriginal) sites, 34 (13.7% of the 249 sites);

   b. low diversity (aboriginal) sites, 129 (51.8%);

   c. debitage only (aboriginal) sites, 4 (1.6%);

   d. fire-cracked rock and bone (aboriginal) sites, 16 (6.4%);

   e. fire-cracked rock only (aboriginal) sites, 12 (4.8%);

   f. rock art (aboriginal) sites, 2 (0.8%);

   g. rock alignment (historic?) sites, 3 (1.2%);

   h. historic structure sites, 20 (8.0%);

   i. historic debris sites, 7 (2.8%); and

   j. missing data (i.e., insufficient information for classification) sites, 22 (8.9%).

Chapter 7: Landforms, Sediments, and Archaeological Deposits along Libby Reservoir

1. There is a paucity of dated archaeological and geological sites in the project area due to a scarcity of organic deposits with unambiguous stratigraphic integrity. The following radiocarbon dates (C-13 adjusted, radiocarbon years) were obtained:

   a. 3,260±100 years, burned bone from site 24LN677;

   b. 8,850±370 years, charcoal from a buried soil;

   c. 11,730±410 years, charcoal from a buried surface; and

   d. 23,565±1,400 years, charcoal from a buried surface.

2. Primary volcanic ash layers were found throughout the project area, but never overlying an archaeological site. Eleven ash samples were analyzed and identified as being one of the following:

   a. Mount Mazama tephra, ca. 6,700 years old;

a. of the 179 aboriginal sites with information available for classification, 49.2 percent have low lithic densities, 19.6 percent have moderate densities, 12.8 percent have high densities, and neither flaked nor nonflaked debitage/tools were observed at 18.4 percent of the sites;

b. fire-cracked rock features (hearths, ovens, boiling stones, or discard piles) were observed at 109 of the 222 sites with aboriginal cultural materials, in frequencies ranging from 1 to 51; scattered fire-cracked rocks were documented at 189 sites; and

c. faunal materials, especially those identified to species, were uncommon, but 116 sites yielded small, burned bone fragments, many of which were associated with fire-cracked rock features.

4. Cultural and chronological classification of recorded sites was based largely on cross-dated artifact types:

a. a total of 80 sites (including two isolated artifact locations) yielded historic (Euroamerican) artifacts dating to the late nineteenth and early twentieth centuries;

b. Historic Period (ca. A.D. 1750-1880) aboriginal artifacts--trade beads and sheet copper ornaments--are from five sites;

c. arrow-size projectile points, indicative of the Late Prehistoric Period (ca. 1,500-200 B.P.), are documented at 30 sites;

d. late Middle Prehistoric Period (ca. 4,500-1,500 B.P.) projectile points are from 32 sites;

e. early Middle Prehistoric Period (ca. 8,000-4,500 B.P.) projectile points come from 25 sites;

f. Early Prehistoric Period (ca. older than 8,000 B.P.) projectile points are from six sites; and

g. an additional 156 sites were classified as aboriginal but did not yield chronologically diagnotic artifacts.

5. The collection includes 32,201 flaked (i.e., tools and debitage) and nonflaked (e.g., hammerstones, edge-ground cobbles, manos, pestles) lithic artifacts from 117 aboriginal sites, but about 78 percent of the artifacts are from five sites, 24LN429, 24LN704, 24LN1054, 24LN1058, and 24LN1073.

6. For analytical purposes, the recovered lithic artifacts were grouped into 10 morphological/functional types. The number of items in each type are as follows: (a) cores, 181; (b) flakes and shatter, 30,723; (c) thick bifaces, 75; (d) thin bifaces, 221; (e)

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Table. (Continued)

Site No. 24IN----	Type of Surface Investigation	Type of Subsurface Investigation	Order of Information Representativeness
698	Late, With Collection	Late, Explored	Eighth
699	Late, With Collection	Late, Probed	Eighth
700	Late, With Collection	Late, Explored	Seventh
701	Late, Grid Collection	Late, Explored	Seventh
702	Late, With Collection	Late, Probed	Fifth
703	Late, No Collection	Not Tested	Eighth
704	Late, Total Collection	Late, Tested	First
705	Late, Grid Collection	Not Tested	Seventh
706	Late, Total Collection	Late, Tested	First
707	Late, Total Collection	Late, Tested	First
708	Late, Total Collection	Late, Explored	First
709	Late, Total Collection	Late, Explored	First
710	Late, With Collection	Not Tested	Seventh
711	Late, Total Collection	Late, Explored	Fourth
712	Late, Total Collection	Late, Explored	Fourth
713	Late, No Collection	Not Tested	Eighth
714	Late, No Collection	Not Tested	Eighth
715	Late, With Collection	Late, Explored	Eighth
716	Late, No Collection	Not Tested	Seventh
1052	Late, With Collection	Not Tested	Ninth
1053	Early, No Collection	Not Tested	Ninth
1054	Late, Total Collection	Late, Tested	First
1055	Late, Total Collection	Not Tested	Fifth
1056	Late, With Collection	Late, Explored	Eighth
1057	Late, Total Collection	Late, Probed	Fifth
1058	Late, Total Collection	Late, Tested	First
1059	Late, Total Collection	Not Tested	Fifth
1060	Late, Total Collection	Not Tested	Fourth
1061	Early, No Collection	Not Tested	Eighth
1062	Early, With Collection	Not Tested	Eighth
1063	Early, No Collection	Not Tested	Ninth
1064	Late, With Collection	Not Tested	Eighth
1065	Early, No Collection	Not Tested	Ninth
1066	Early, With Collection	Not Tested	Eighth
1067	Early, No Collection	Not Tested	Ninth
1068	Early, No Collection	Not Tested	Ninth
1069	Early, No Collection	Not Tested	Ninth
1070	Late, With Collection	Not Tested	Eighth
1072	Late, With Collection	Not Tested	Eighth
1073	Late, Total Collection	Late, Tested	Fourth
1074	Late, Total Collection	Not Tested	Fourth
1075	Early, With Collection	Not Tested	Eighth
1076	Late, Total Collection	Not Tested	Fifth

Table. (Continued)

Site No. 24IN----	Type of Surface Investigation	Type of Subsurface Investigation	Order of Information Representativeness
1077	Early, No Collection	Not Tested	Seventh
1078	Early, No Collection	Not Tested	Eighth
1079	Early, No Collection	Not Tested	Eighth
1080	Late, With Collection	Not Tested	Eighth
1081	Early, With Collection	Not Tested	Eighth
1082	Early, With Collection	Not Tested	Eighth
1083	Early, No Collection	Not Tested	Eighth
1084	Early, No Collection	Not Tested	Eighth
1085	Early, No Collection	Not Tested	Eighth
1086	Early, With Collection	Not Tested	Eighth
1087	Late, Total Collection	Not Tested	Fifth
1089	Early, No Collection	Not Tested	Eighth
1090	Early, No Collection	Not Tested	Eighth
1091	Early, No Collection	Not Tested	Seventh
1092	Early, With Collection	Not Tested	Seventh
1093	Late, With Collection	Not Tested	Seventh
1094	Late, With Collection	Not Tested	Eighth
1095	Early, No Collection	Not Tested	Eighth
1096	Early, With Collection	Not Tested	Eighth
1097	Late, Total Collection	Late, Explored	Fourth
1098	Early, No Collection	Not Tested	Eighth
1099	Early, No Collection	Not Tested	Eighth
1100	Early, No Collection	Not Tested	Eighth
1101	Early, No Collection	Not Tested	Eighth
1102	Early, No Collection	Not Tested	Eighth
1103	Early, No Collection	Not Tested	Eighth
1142	Early, No Collection	Not Tested	Ninth
1143	Early, No Collection	Not Tested	Ninth
1144	Late, With Collection	Late, Tested	Fourth
1146	Late, With Collection	Not Tested	Eighth
1147	Early, No Collection	Not Tested	Ninth
1148	Early, With Collection	Not Tested	Ninth
1149	Early, No Collection	Not Tested	Ninth
1150	Early, No Collection	Not Tested	Ninth

Table. (Continued)

Site No. 24LN----	Type of Surface Investigation	Type of Subsurface Investigation	Order of Information Representativeness
439	Late, No Collection	Not Tested	Eighth
440	Late, No Collection	Not Tested	Eighth
441	Late, With Collection	Not Tested	Eighth
442	Late, With Collection	Not Tested	Eighth
443	Late, With Collection	Late, Explored	Fifth
444	Late, No Collection	Not Tested	Eighth
445	Late, No Collection	Not Tested	Eighth
446	Late, With Collection	Late, Explored	Eighth
447	Late, Total Collection	Not Tested	Fifth
448	Late, No Collection	Not Tested	Seventh
449	Late, No Collection	Not Tested	Eighth
451	Late, No Collection	Not Tested	Eighth
452	Late, No Collection	Not Tested	Eighth
487	Late, With Collection	Not Tested	Eighth
488	Late, With Collection	Not Tested	Fifth
501	Early, No Collection	Not Tested	Ninth
502	Early, No Collection	Early, Tested	Ninth
503	Early, No Collection	Early, Tested	Ninth
504	Early, No Collection	Early, Tested	Ninth
505	Early, No Collection	Not Tested	Ninth
506	Early, No Collection	Early, Tested	Ninth
507	Early, No Collection	Not Tested	Ninth
508	Early, No Collection	Not Tested	Ninth
509	Early, No Collection	Early, Tested	Ninth
510	Early, No Collection	Not Tested	Ninth
512	Early, No Collection	Not Tested	Ninth
513	Early, No Collection	Early, Tested	Ninth
514	Early, No Collection	Not Tested	Ninth
515	Early, With Collection	Early, Tested	Eighth
516	Early, No Collection	Not Tested	Ninth
517	Early, No Collection	Early, Tested	Ninth
518	Early, No Collection	Not Tested	Ninth
520	Early, No Collection	Not Tested	Ninth
521	Late, With Collection	Early, Tested	Seventh
522	Early, No Collection	Not Tested	Ninth
523	Early, No Collection	Early, Tested	Ninth
524	Early, No Collection	Not Tested	Ninth
525	Early, No Collection	Early, Tested	Ninth
530	Early, No Collection	Not Tested	Ninth
651	Late, No Collection	Not Tested	Seventh
652	Late, With Collection	Not Tested	Eighth
653	Late, With Collection	Late, Probed	Eighth
654	Late, No Collection	Late, Probed	Seventh

Table. (Continued)

Site No. 24LN----	Type of Surface Investigation	Type of Subsurface Investigation	Order of Information Representativeness
655	Late, With Collection	Not Tested	Seventh
656	Late, Grid Collection	Late, Tested	Fourth
657	Late, With Collection	Not Tested	Seventh
658	Late, No Collection	Not Tested	Seventh
659	Late, No Collection	Not Tested	Seventh
660	Late, Grid Collection	Not Tested	Seventh
661	Late, With Collection	Late, Probed	Eighth
662	Late, With Collection	Not Tested	Seventh
663	Late, With Collection	Not Tested	Seventh
664	Late, No Collection	Not Tested	Seventh
665	Late, Total Collection	Late, Explored	Third
666	Late, Total Collection	Late, Explored	First
667	Late, With Collection	Not Tested	Seventh
668	Late, With Collection	Not Tested	Seventh
669	Late, No Collection	Not Tested	Eighth
670	Late, No Collection	Not Tested	Eighth
671	Late, With Collection	Not Tested	Eighth
672	Late, With Collection	Late, Probed	Seventh
673	Late, Total Collection	Not Tested	Fourth
674	Late, Total Collection	Not Tested	Fourth
675	Late, Total Collection	Not Tested	Fourth
676	Late, With Collection	Not Tested	Eighth
677	Late, Total Collection	Late, Tested	Third
678	Late, No Collection	Late, Probed	Seventh
679	Late, Total Collection	Late, Explored	Third
680	Late, No Collection	Not Tested	Eighth
681	Late, No Collection	Not Tested	Eighth
682	Late, With Collection	Not Tested	Eighth
683	Late, No Collection	Not Tested	Seventh
684	Late, With Collection	Not Tested	Eighth
685	Late, With Collection	Not Tested	Seventh
686	Late, Total Collection	Late, Explored	Fifth
687	Late, With Collection	Not Tested	Seventh
688	Late, With Collection	Late, Explored	Eighth
689	Late, No Collection	Not Tested	Eighth
690	Late, With Collection	Late, Probed	Eighth
691	Late, Grid Collection	Late, Explored	Fifth
692	Late, Total Collection	Not Tested	Fifth
693	Late, No Collection	Not Tested	Eighth
694	Late, No Collection	Not Tested	Seventh
695	Late, With Collection	Late, Probed	Eighth
696	Late, With Collection	Not Tested	Eighth
697	Late, With Collection	Not Tested	Eighth

Table. Types of Investigations and Representativeness of Resulting Data from Sites.

Site No. 24LN----	Type of Surface Investigation	Type of Subsurface Investigation	Order of Information Representativeness
5	Early, No Collection	Not Tested	Ninth
7	Early, No Collection	Early, Tested	Ninth
8	Early, No Collection	Not Tested	Ninth
9	Early, No Collection	Not Tested	Ninth
11	Early, No Collection	Not Tested	Ninth
12	Early, No Collection	Not Tested	Ninth
47	Early, No Collection	Not Tested	Ninth
188	Early, With Collection	Not Tested	Sixth
189	Early, With Collection	Not Tested	Sixth
190	Late, Grid Collection	Late, Explored	Fifth
191	Early, With Collection	Not Tested	Sixth
193	Late, With Collection	Late, Probed	Sixth
364	Late, Total Collection	Late, Tested	Third
365	Late, Total Collection	Not Tested	Third
366	Late, Total Collection	Late, Tested	Third
367	Late, No Collection	Not Tested	Seventh
368	Late, With Collection	Not Tested	Seventh
369	Late, Grid Collection	Late, Explored	Second
370	Late, No Collection	Not Tested	Eighth
371	Late, Total Collection	Not Tested	Fourth
372	Late, Total Collection	Not Tested	Fourth
373	Late, Grid Collection	Late, Explored	Third
374	Late, With Collection	Not Tested	Eighth
375	Late, Total Collection	Late, Tested	Third
376	Late, Total Collection	Not Tested	Fifth
377	Late, No Collection	Not Tested	Eighth
378	Late, Total Collection	Not Tested	Fifth
380	Late, No Collection	Not Tested	Eighth
381	Late, With Collection	Not Tested	Eighth
382	Late, With Collection	Not Tested	Eighth
383	Late, With Collection	Not Tested	Eighth
384	Late, Grid Collection	Late, Explored	Third
385	Late, Grid Collection	Late, Explored	Third
386	Late, Total Collection	Late, Explored	Third
387	Late, Grid Collection	Late, Explored	Fourth
388	Late, Grid Collection	Late, Explored	Second
389	Late, With Collection	Not Tested	Eighth
390	Late, Total Collection	Not Tested	Seventh
391	Late, With Collection	Not Tested	Eighth
392	Late, Total Collection	Late, Probed	Third
393	Late, With Collection	Not Tested	Eighth
394	Late, Total Collection	Late, Explored	Fourth
395	Late, With Collection	Not Tested	Eighth
396	Late, Total Collection	Late, Tested	First
397	Late, With Collection	Not Tested	Eighth
398	Late, With Collection	Not Tested	Eighth
399	Late, With Collection	Not Tested	Eighth
400	Late, Total Collection	Not Tested	Fifth
401	Late, With Collection	Not Tested	Seventh
402	Late, Total Collection	Not Tested	Fifth
403	Late, No Collection	Not Tested	Eighth
404	Late, No Collection	Not Tested	Eighth
405	Late, No Collection	Not Tested	Eighth
406	Late, No Collection	Not Tested	Eighth
407	Late, No Collection	Not Tested	Eighth
408	Late, No Collection	Not Tested	Eighth
409	Late, No Collection	Not Tested	Eighth
410	Late, With Collection	Not Tested	Eighth
411	Late, No Collection	Not Tested	Eighth
412	Late, No Collection	Not Tested	Eighth
413	Late, No Collection	Not Tested	Eighth
414	Late, No Collection	Not Tested	Seventh
415	Late, No Collection	Not Tested	Eighth
416	Late, Total Collection	Not Tested	Fourth
417	Late, Grid Collection	Late, Tested	First
418	Late, With Collection	Not Tested	Eighth
419	Late, Total Collection	Not Tested	Fifth
420	Late, With Collection	Not Tested	Eighth
421	Late, With Collection	Not Tested	Eighth
422	Late, Total Collection	Not Tested	Eighth
423	Late, Grid Collection	Late, Explored	Fourth
424	Late, No Collection	Late, Explored	Eighth
425	Late, With Collection	Not Tested	Eighth
426	Late, No Collection	Not Tested	Eighth
427	Late, Grid Collection	Late, Explored	Third
428	Late, No Collection	Not Tested	Seventh
429	Late, Total Collection	Late, Probed	Third
430	Late, No Collection	Not Tested	Eighth
431	Late, No Collection	Not Tested	Seventh
432	Late, With Collection	Not Tested	Eighth
433	Late, No Collection	Not Tested	Seventh
434	Late, No Collection	Not Tested	Eighth
435	Late, No Collection	Not Tested	Eighth
436	Late, No Collection	Not Tested	Eighth
437	Late, No Collection	Not Tested	Eighth
438	Late, No Collection	Not Tested	Seventh

Table. (Continued)

Fifth Level, N=18 (7.2%)

Available information and collections are representative of the various artifact classes, as in the first four levels, but FCR are represented only in terms of presence or absence.

Sixth Level, N=4 (1.6%)

Collections are representative only of the flaked and nonflaked lithic tools. Lithic debitage and other artifact types are represented only in terms of presence or absence.

Seventh Level, N=38 (15.3%)

Aboriginal cultural materials, other than bone and/or fire-cracked rock, were not observed at the site, but the kind of information available is representative of the site's contents.

Eighth Level, N=104 (41.8%)

Flaked lithics and nonflaked lithics, if present, were either not collected or if collected, do not necessarily quantitatively reflect what was observed at the site. Although the individual collections cannot be considered as representative of the site's contents, the presence/absence data recorded on site forms reflect what was observed at the site. Furthermore, the overall tendency was to collect tools, but only very rough estimates were made of the quantity of debitage.

Ninth Level, N=42 (16.9%)

Available information is not adequate to assess the representativeness of the collection. This category is used primarily for sites recorded prior to 1981 and that either were inundated or could not be relocated during the 1981-1982 project.

Not Tested, N=180 (72.3%)

Three sites were not subjected to any type of subsurface investigation.

Representativeness of Recovered Information

Each site was assessed in terms of how well the available information, especially the collected artifacts, represents or reflects the kinds and relative frequencies of artifact types observed at the site (see Table). The assessment of representativeness is systematically judgmental, in that it is based on controlled observations about the nature and distribution of cultural materials observed at each site. In other words, it is not a quantitatively algorithmic assessment based on a random sample of artifacts or information. Because the methods and techniques varied during the course of the project, there are numerous ways in which the recovered information reflects what was observed in the field. Nine levels of general representativeness have been identified. They are ordered from most to least representative of what was observed at the site. The first five levels differ only in terms of the available information on fire-cracked rock. The remaining levels differ considerably in how well the available artifacts and/or information reflect what was present at a given site when it was documented.

First Level, N=10 (4%)

Available information and collections are representative of all artifact types observed at the site, including flaked (i.e., debitage and tools) and nonflaked (e.g., ground, battered, or pecked stone) lithics, as well as fire-cracked rocks (FCR).

Second Level, N=2 (0.8%)

Available information and collections are representative of the various types of artifacts observed at the site, including flaked and nonflaked lithics. FCR were not collected but are represented in terms of their numbers, weights, and material types.

Third Level, N=14 (5.6%)

Available information and collections are representative of the various artifact classes, as in the first two levels, but FCR are represented by the number of specimens and their weight.

Fourth Level, N=17 (6.8%)

Available information and collections are representative of the various artifact classes, as is the case for the first three levels. However, FCR are represented either by the number of specimens or by weights.

Late, Total Collection, N=47 (18.9%)

This refers to sites recorded at any point in time; some had been collected using the "grab" sample technique prior to 1981. With the exception of fire-cracked rock, all observed cultural materials were collected using the total "grab", point provenience, and/or grid unit collection techniques. Recovered materials were available for this study.

Summary of Types of Subsurface Investigations

Subsurface investigations refer to efforts to recover cultural materials buried beneath the ground surface. This subsection documents the specific type of subsurface investigation at each site, as well as the general time period when the investigation took place. All 249 sites are included. Sites subjected to full scale testing also were subjected to probe and exploratory testing; many sites listed as being tested by the exploratory technique were also probed. The Table provides a site by site listing of subsurface investigation strategies.

Early, Tested, N=12 (4.8%)

Excavations were conducted prior to 1981 using a variety of techniques, usually 1 x 1 m or larger test pits and in some cases mechanical excavation with a backhoe. Recovered cultural materials were not available for this study.

Late, Probed, N=13 (5.2%)

This is the most limited type of subsurface investigation used during the 1981-1982 project. It refers to a variety of rapid excavation techniques such as shallow trowel and shovel pits or auger and post holes. Backdirt was examined carefully for artifacts. Usually, but not always, it was screened. Recovered artifacts were available for this study.

Late, Explored, N=30 (12.1%)

Exploratory testing is an intermediate subsurface investigative technique used during the 1981-1982 seasons. It refers to the excavation of small, deep, and/or large, shallow test pits. The sizes of units varied from .2 x .2 m to .5 x .5 m to 1 x .5 m and units 1 x 1 m or larger in size were shovel skimmed. All backdirt was screened and recovered artifacts were available for this study.

Late, Tested, N=14 (5.6%)

This is the most intensive type of subsurface investigation employed during the 1981-1982 project. Excavation units were larger and often deeper than exploratory test pits. These full scale test excavated sites were investigated using test pits that ranged from 1 x 1 m to 2 x 2 m in size. All backdirt was screened and recovered artifacts were available for this study.

APPENDIX B

TYPES OF INVESTIGATION AND REPRESENTATIVENESS OF RECOVERED INFORMATION AT EACH OF THE 249 KNOWN SITES

by
Alston V. Thoms

Summary of Types of Surface Investigations at Sites

This subsection of Appendix B is primarily a key to the following table. It describes the methods and techniques employed to recover cultural materials from the surface of the sites. It also documents when the site was recorded and/or when materials were collected.

Six types of surface investigations are recognized as having been implemented for the 249 known sites including those recorded and collected by Shiner (1950), Taylor (1973), and others. The Table provides a site by site listing of the kinds of surface investigations.

Early, No Collection, N=57 (22.9% of the 249 sites)

This refers to sites recorded prior to 1981. Cultural materials either were not collected, or if collected, were not available for this study.

Early, With Collection, N=13 (5.2%)

This refers to sites recorded prior to 1981; some or all of the collected materials were available for this study, including artifacts collected by Roll and Bailey (1979). All such collections were made using the "grab" technique, wherein a portion of the artifacts, usually formed tools, were collected from the site, but specific intrasite proveniences were not recorded.

Late, No Collection, N=53 (21.3%)

This refers to sites recorded in 1981 or 1982. Observed cultural materials were documented on site forms, but not collected.

Late, With Collection, N=64 (25.7%)

This refers to sites recorded at any point in time. In all cases, a portion of the recovered cultural material was collected in 1981 or 1982; in some cases a portion of the recovered items also was collected prior to 1981. Collections were made using the "grab" and/or point provenience techniques, in the latter case, specific intrasite artifact proveniences were recorded in relation to the site datum. Collected materials were available for this study.

Late, Grid Collection, N=15 (6.0%)

This also refers to sites recorded at any point in time. For some sites "grab" samples were collected prior to 1981. During the 1981 and 1982 seasons, controlled collections from these sites used the grid unit and "dog-leash" techniques as well as the shovel skim technique. All collected materials were available for this study.

APPENDIX A

PROPOSALS AND OTHER CONTRACT AND REVIEW RELATED DOCUMENTS

The original plan was to include the scope-of-work, proposals, peer reviews, and related documents in this appendix. These were as follows:

1. "Statement of Work: Libby Dam-Lake Koocanusa Cultural Resources Survey," February 6, 1981, prepared by the Seattle District, US Army Corps of Engineers (ACOE).

2. Research Proposal entitled, "A Cultural Resource Survey of Lake Koocanusa, Northwestern Montana," February 17, 1981, by Randall F. Schalk, Principal Investigator, Washington State University (WSU).

3. "Statement of Work: Libby Dam-Lake Koocanusa Cultural Resources Survey 1981-1982," September 10, 1981, by the Seattle District, ACOE.

4. Research Proposal entitled, "Cultural Resource Survey and Testing in the Libby Reservoir, Northwestern Montana, 1982," October 28, 1981, by Randall F. Schalk, WSU.

5. Letter to Dr. Schalk, Principal Investigator (WSU), from S. F. Dice (ACOE) dated April 11, 1983, regarding "Comments on Draft Cultural Resources Protection Plan, Libby Dam-Lake Koocanusa Cultural Resources Survey" and including instructions for the final technical report.

6. "Statement of Work: Cultural Resources Survey Reporting for Libby Dam-Lake Koocanusa, Kootenai River, Montana," August 16, 1983, by Seattle District, ACOE.

7. Letter to Alston V. Thoms, Project Director (WSU), from S. F. Dice (ACOE) dated July 6, 1984, regarding "Comments on Draft Final Report for Libby Dam-Lake Koocanusa Cultural Resources Survey."

Inclusion of the above documents, totaling over 100 pages, was considered impractical due to the high costs and difficulties in binding a very large report. However, copies of these documents relating to the Washington State University/Libby Archaeological Project can be obtained (for the cost of photocopying) by writing to the Assistant Director, Center for Northwest Anthropology, Washington State University, Pullman, Washington 99163-3112.

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APPENDIX C

ENVIRONMENTAL CHARACTERISTICS, SITE CONTENTS, ISOLATED ARTIFACTS, LITHIC ARTIFACTS BY MORPHOFUNCTIONAL CLASSIFICATION AND BROAD CHARACTERISTICS OF THE 249 KNOWN SITES

by
Alston V. Thoms

This appendix is a tabulation of data generated for the known sites. It represents an inventory of cultural and environmental characteristics for sites recorded during this project and for sites recorded prior to 1981. Some of the cultural material recovered before 1981 (e.g., Roll and Bailey 1979) was available during this project, but most of it was not available (e.g., Shiner 1950; Taylor 1973). Information regarding cultural materials recovered during previous projects (excepting Roll and Bailey 1979) was extracted from available reports (e.g., Shiner 1950; Taylor 1973). Locational data, for all sites were extracted from topographic maps (see Chapter 6). This appendix includes the following tables: (1) C-1. Locational and Environmental Characteristics; (2) C-2. Site Content Summary; (3) C-3. Isolated Artifact Information; (4) C-4. Frequencies of Recovered Artifacts; and (5) C-5. Broad Characteristics.

Table C-1. Locational and Environmental Characteristics of Sites (see text for definitions, Chapter 6, first section).

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
5	Tobacco Pl.	West	Lower	Bar	Good	Moderate
7	Tobacco Pl.	East	Lower	Bar	Good	Far
8	Tobacco Pl.	East	Lower	Bar	Moderate	Moderate
9	Tobacco Pl.	East	Upper	Bar	Good	Moderate
11	Tobacco Pl.	East	Lower	Bar	Moderate	Near
12	Upper Can.	East	Lower	Bar	Moderate	Near
47	Lower Can.	East	Upper	Fan	Good	Moderate
188	Tobacco Pl.	East	Middle	Fan	Good	Far
189	Lower Can.	East	Upper	Bar	Good	Far
190	Tobacco Pl.	East	Upper	Bar	Good	Moderate
191	Tobacco Pl.	East	Upper	Bar	Moderate	Far
193	Lower Can.	West	Upper	Fan	Moderate	Far
364	Lower Can.	East	Middle	Fan	Good	Moderate
365	Lower Can.	West	Middle	Bar	Moderate	Moderate
366	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
367	Lower Can.	East	Upper	Bar	Poor	Far
368	Lower Can.	East	Middle	Bar	Moderate	Far
369	Lower Can.	East	Middle	Bar	Moderate	Far
370	Lower Can.	East	Upper	Fan	Moderate	Far
371	Lower Can.	East	Middle	Bar	Moderate	Far
372	Lower Can.	East	Middle	Bar	Poor	Far
373	Lower Can.	East	Middle	Bar	Good	Far
374	Lower Can.	West	Upper	Fan	Poor	Far
375	Lower Can.	West	Middle	Bar	Moderate	Far
376	Lower Can.	West	Upper	Bar	Moderate	Far
377	Lower Can.	East	Upper	Fan	Good	Moderate
378	Lower Can.	West	Upper	Fan	Moderate	Far
380	Lower Can.	East	Upper	Bar	Good	Far
381	Lower Can.	West	Middle	Bar	Moderate	Far
382	Lower Can.	West	Upper	Bar	Moderate	Far
383	Lower Can.	West	Lower	Fan	Moderate	Far
384	Upper Can.	East	Middle	Bar	Moderate	Far
385	Upper Can.	East	Middle	Fan	Good	Far
386	Upper Can.	East	Upper	Fan	Good	Far
387	Upper Can.	East	Upper	Fan	Moderate	Far
388	Upper Can.	East	Upper	Fan	Good	Far
389	Upper Can.	West	Middle	Fan	Moderate	Far
390	Upper Can.	East	Middle	Fan	Moderate	Far
391	Upper Can.	East	Middle	Bar	Poor	Moderate
392	Upper Can.	East	Middle	Fan	Good	Moderate
393	Upper Can.	East	Upper	Fan	Good	Near
394	Upper Can.	West	Upper	Fan	Good	Near
395	Upper Can.	West	Middle	Bar	Good	Near

Table C-1. (Continued)

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
396	Tobacco Pl.	East	Middle	Bar	Poor	Moderate
397	Tobacco Pl.	East	Upper	Bar	Poor	Near
398	Tobacco Pl.	East	Middle	Dune	Moderate	Far
399	Tobacco Pl.	East	Middle	Dune	Moderate	Far
400	Tobacco Pl.	East	Middle	Dune	Moderate	Far
401	Tobacco Pl.	East	Middle	Dune	Good	Far
402	Tobacco Pl.	East	Middle	Dune	Moderate	Far
403	Lower Can.	East	Upper	Fan	Poor	Near
404	Lower Can.	West	Upper	Bar	Good	Far
405	Lower Can.	West	Upper	Bar	Good	Far
406	Lower Can.	West	Upper	Bar	Good	Far
407	Lower Can.	West	Upper	Bar	Moderate	Far
408	Lower Can.	West	Upper	Bar	Good	Far
409	Lower Can.	West	Upper	Bar	Good	Far
410	Lower Can.	West	Upper	Bar	Good	Far
411	Tobacco Pl.	East	Middle	Bar	Poor	Far
412	Tobacco Pl.	East	Upper	Bar	Poor	Far
413	Tobacco Pl.	East	Middle	Bar	Moderate	Far
414	Tobacco Pl.	East	Middle	Bar	Moderate	Far
415	Tobacco Pl.	East	Middle	Bar	Moderate	Far
416	Tobacco Pl.	East	Middle	Bar	Poor	Far
417	Tobacco Pl.	East	Middle	Bar	Moderate	Moderate
418	Tobacco Pl.	East	Middle	Bar	Poor	Far
419	Tobacco Pl.	East	Middle	Bar	Poor	Far
420	Tobacco Pl.	East	Middle	Bar	Poor	Far
421	Tobacco Pl.	East	Middle	Bar	Poor	Moderate
422	Tobacco Pl.	East	Middle	Bar	Moderate	Moderate
423	Tobacco Pl.	West	Lower	Bar	Good	Near
424	Tobacco Pl.	West	Lower	Bar	Moderate	Far
425	Tobacco Pl.	East	Lower	Dune	Moderate	Far
426	Tobacco Pl.	East	Lower	Dune	Good	Moderate
427	Tobacco Pl.	East	Lower	Dune	Good	Near
428	Tobacco Pl.	East	Lower	Dune	Moderate	Near
429	Tobacco Pl.	East	Lower	Dune	Good	Near
430	Tobacco Pl.	East	Lower	Dune	Good	Moderate
431	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
432	Tobacco Pl.	East	Lower	Dune	Moderate	Far
433	Tobacco Pl.	East	Lower	Dune	Good	Far
434	Tobacco Pl.	East	Lower	Dune	Good	Far
435	Tobacco Pl.	East	Lower	Dune	Good	Far
436	Tobacco Pl.	East	Middle	Dune	Moderate	Far
437	Tobacco Pl.	East	Lower	Dune	Moderate	Far
438	Tobacco Pl.	East	Middle	Dune	Moderate	Far

Table C-1. (Continued)

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
439	Tobacco Pl.	East	Middle	Dune	Good	Far
440	Tobacco Pl.	East	Middle	Dune	Good	Far
441	Tobacco Pl.	East	Middle	Dune	Moderate	Far
442	Tobacco Pl.	East	Middle	Dune	Moderate	Far
443	Tobacco Pl.	West	Lower	Bar	Poor	Moderate
444	Tobacco Pl.	East	Middle	Bar	Moderate	Far
445	Tobacco Pl.	East	Middle	Bar	Moderate	Far
446	Lower Can.	West	Middle	Bar	Moderate	Moderate
447	Tobacco Pl.	East	Middle	Bar	Poor	Far
448	Tobacco Pl.	East	Middle	Fan	Moderate	Far
449	Tobacco Pl.	East	Middle	Fan	Moderate	Far
451	Tobacco Pl.	East	Lower	Bar	Good	Near
452	Tobacco Pl.	West	Middle	Bar	Moderate	Far
487	Lower Can.	West	Upper	Bar	Poor	Far
488	Tobacco Pl.	West	Middle	Bar	Poor	Far
501	Lower Can.	West	Lower	Fan	Moderate	Near
502	Lower Can.	East	Lower	Bar	Moderate	Near
503	Lower Can.	East	Lower	Bar	Moderate	Near
504	Lower Can.	East	Lower	Bar	Good	Moderate
505	Lower Can.	East	Lower	Fan	Moderate	Near
506	Lower Can.	East	Lower	Bar	Good	Near
507	Lower Can.	East	Lower	Bar	Moderate	Near
508	Upper Can.	East	Lower	Bar	Moderate	Moderate
509	Upper Can.	West	Lower	Fan	Moderate	Near
510	Upper Can.	West	Lower	Other	Good	Far
512	Tobacco Pl.	East	Lower	Bar	Good	Near
513	Tobacco Pl.	West	Lower	Bar	Moderate	Near
514	Tobacco Pl.	West	Lower	Bar	Moderate	Near
515	Tobacco Pl.	West	Middle	Bar	Moderate	Far
516	Tobacco Pl.	West	Middle	Bar	Moderate	Moderate
517	Tobacco Pl.	West	Lower	Bar	Moderate	Near
518	Tobacco Pl.	West	Lower	Bar	Moderate	Near
520	Tobacco Pl.	East	Lower	Bar	Good	Near
521	Tobacco Pl.	East	Lower	Dune	Good	Near
522	Tobacco Pl.	East	Lower	Bar	Moderate	Moderate
523	Upper Can.	West	Middle	Fan	Moderate	Far
524	Tobacco Pl.	East	Lower	Bar	Good	Moderate
525	Lower Can.	West	Lower	Bar	Good	Far
530	Upper Can.	West	Middle	Fan	Poor	Near
651	Upper Can.	East	Upper	Fan	Good	Moderate
652	Tobacco Pl.	West	Lower	Dune	Poor	Moderate
653	Tobacco Pl.	East	Lower	Dune	Good	Near
654	Tobacco Pl.	East	Lower	Dune	Good	Moderate

Table C-1. (Continued)

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
655	Tobacco Pl.	East	Lower	Dune	Moderate	Near
656	Upper Can.	West	Middle	Fan	Moderate	Moderate
657	Tobacco Pl.	East	Lower	Dune	Good	Near
558	Tobacco Pl.	East	Lower	Dune	Good	Moderate
659	Tobacco Pl.	East	Lower	Dune	Good	Far
660	Tobacco Pl.	East	Lower	Dune	Good	Far
661	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
662	Tobacco Pl.	East	Lower	Dune	Good	Far
663	Tobacco Pl.	East	Lower	Dune	Good	Moderate
664	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
665	Tobacco Pl.	East	Lower	Bar	Good	Far
666	Tobacco Pl.	East	Lower	Dune	Moderate	Near
667	Tobacco Pl.	East	Lower	Dune	Good	Far
668	Tobacco Pl.	East	Lower	Dune	Good	Moderate
669	Upper Can.	East	Upper	Fan	Good	Far
670	Upper Can.	East	Upper	Fan	Good	Far
671	Tobacco Pl.	East	Lower	Dune	Moderate	Far
672	Tobacco Pl.	East	Lower	Dune	Poor	Far
673	Tobacco Pl.	East	Middle	Dune	Good	Far
674	Tobacco Pl.	East	Middle	Dune	Moderate	Far
675	Tobacco Pl.	East	Middle	Dune	Moderate	Far
676	Tobacco Pl.	East	Lower	Dune	Good	Far
677	Tobacco Pl.	East	Middle	Dune	Good	Far
678	Tobacco Pl.	East	Middle	Bar	Good	Near
679	Lower Can.	East	Upper	Fan	Good	Moderate
680	Lower Can.	East	Middle	Fan	Good	Far
681	Lower Can.	East	Middle	Fan	Poor	Far
682	Tobacco Pl.	East	Middle	Dune	Good	Far
683	Tobacco Pl.	East	Middle	Dune	Good	Far
684	Tobacco Pl.	East	Middle	Dune	Moderate	Far
685	Tobacco Pl.	East	Middle	Dune	Good	Far
686	Upper Can.	East	Upper	Fan	Good	Far
687	Upper Can.	East	Middle	Bar	Good	Far
688	Upper Can.	East	Middle	Bar	Poor	Far
689	Upper Can.	East	Upper	Fan	Moderate	Far
690	Tobacco Pl.	East	Lower	Dune	Good	Near
691	Tobacco Pl.	East	Lower	Dune	Good	Far
692	Lower Can.	East	Middle	Fan	Good	Far
693	Upper Can.	West	Middle	Fan	Moderate	Moderate
694	Upper Can.	West	Middle	Fan	Moderate	Moderate
695	Upper Can.	West	Middle	Fan	Good	Moderate
696	Tobacco Pl.	East	Middle	Dune	Moderate	Far
697	Lower Can.	East	Middle	Bar	Moderate	Far

Table C-1. (Continued)

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
698	Upper Can.	East	Middle	Bar	Moderate	Far
699	Upper Can.	East	Middle	Bar	Moderate	Far
700	Upper Can.	East	Middle	Bar	Good	Far
701	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
702	Lower Can.	West	Upper	Fan	Poor	Far
703	Lower Can.	East	Middle	Bar	Moderate	Far
704	Tobacco Pl.	East	Upper	Dune	Moderate	Far
705	Tobacco Pl.	East	Middle	Dune	Good	Far
706	Tobacco Pl.	East	Middle	Dune	Good	Far
707	Lower Can.	East	Upper	Fan	Good	Near
708	Lower Can.	West	Upper	Fan	Moderate	Far
709	Lower Can.	West	Upper	Fan	Moderate	Far
710	Tobacco Pl.	East	Middle	Bar	Poor	Near
711	Lower Can.	West	Upper	Bar	Good	Far
712	Lower Can.	West	Middle	Bar	Moderate	Far
713	Tobacco Pl.	East	Middle	Bar	Moderate	Moderate
714	Tobacco Pl.	East	Middle	Bar	Moderate	Far
715	Tobacco Pl.	East	Middle	Bar	Good	Far
716	Upper Can.	West	Middle	Fan	Good	Near
1052	Lower Can.	East	Middle	Bar	Good	Far
1053	Lower Can.	West	Middle	Bar	Good	Moderate
1054	Lower Can.	West	Middle	Bar	Good	Moderate
1055	Lower Can.	West	Middle	Bar	Good	Far
1056	Lower Can.	West	Middle	Bar	Moderate	Moderate
1057	Lower Can.	West	Middle	Bar	Good	Near
1058	Lower Can.	West	Middle	Bar	Moderate	Moderate
1059	Lower Can.	West	Middle	Bar	Moderate	Far
1060	Lower Can.	West	Middle	Bar	Good	Far
1061	Lower Can.	West	Upper	Bar	Good	Far
1062	Lower Can.	West	Middle	Bar	Good	Far
1063	Tobacco Pl.	East	Middle	Bar	Poor	Near
1064	Tobacco Pl.	East	Middle	Bar	Poor	Far
1065	Tobacco Pl.	East	Lower	Bar	Good	Moderate
1066	Lower Can.	East	Upper	Fan	Moderate	Moderate
1067	Tobacco Pl.	East	Lower	Bar	Good	Moderate
1068	Tobacco Pl.	East	Lower	Bar	Good	Moderate
1069	Tobacco Pl.	East	Lower	Bar	Good	Near
1070	Lower Can.	East	Upper	Fan	Moderate	Moderate
1072	Lower Can.	Fast	Upper	Bar	Good	Far
1073	Lower Can.	West	Upper	Fan	Good	Far
1074	Lower Can.	West	Upper	Bar	Good	Far
1075	Lower Can.	East	Upper	Fan	Poor	Moderate
1076	Lower Can.	East	Upper	Fan	Moderate	Far

Table C-1. (Continued)

Site No 24LN----	Reservoir Segment*	Side of River	Terrace Setting	Type of Landform	Solar Exposure	Distance to Water
1077	Upper Can.	East	Upper	Fan	Moderate	Near
1078	Upper Can.	East	Upper	Fan	Good	Far
1079	Upper Can.	East	Middle	Bar	Poor	Moderate
1080	Upper Can.	West	Upper	Bar	Good	Far
1081	Tobacco Pl.	East	Middle	Bar	Good	Far
1082	Tobacco Pl.	East	Upper	Dune	Moderate	Far
1083	Tobacco Pl.	West	Middle	Other	Good	Far
1084	Tobacco Pl.	West	Middle	Other	Good	Far
1085	Tobacco Pl.	West	Middle	Other	Good	Moderate
1086	Tobacco Pl.	East	Middle	Bar	Moderate	Far
1087	Tobacco Pl.	East	Middle	Bar	Poor	Far
1089	Tobacco Pl.	East	Upper	Bar	Good	Moderate
1090	Tobacco Pl	Fast	Upper	Bar	Good	Near
1091	Tobacco Pl.	West	Middle	Bar	Good	Far
1092	Tobacco Pl.	East	Middle	Bar	Good	Far
1093	Tobacco Pl.	East	Middle	Bar	Moderate	Far
1094	Tobacco Pl.	East	Lower	Dune	Good	Far
1095	Tobacco Pl.	East	Lower	Dune	Good	Far
1096	Tobacco Pl.	East	Lower	Dune	Moderate	Moderate
1097	Tobacco Pl.	East	Lower	Bar	Poor	Moderate
1098	Tobacco Pl.	East	Middle	Bar	Good	Far
1099	Tobacco Pl.	East	Lower	Bar	Good	Moderate
1100	Tobacco Pl.	East	Lower	Bar	Good	Moderate
1101	Tobacco Pl.	East	Upper	Bar	Good	Far
1102	Tobacco Pl.	East	Lower	Bar	Moderate	Moderate
1103	Tobacco Pl.	East	Lower	Bar	Moderate	Moderate
1142	Tobacco Pl.	East	Lower	Dune	Good	Moderate
1143	Tobacco Pl.	East	Lower	Bar	Poor	Moderate
1144	Tobacco Pl.	East	Lower	Dune	Good	Near
1146	Tobacco Pl.	East	Lower	Dune	Poor	Near
1147	Tobacco Pl.	East	Lower	Bar	Moderate	Far
1148	Tobacco Pl.	East	Lower	Bar	Moderate	Far
1149	Tobacco Pl.	East	Upper	Bar	Moderate	Moderate
1150	Tobacco Pl.	East	Upper	Bar	Moderate	Moderate

*Key
Tobacco Pl.: Tobacco Plains Zone
Upper Can. : Upper Canyon Zone
Lower Can. : Lower Canyon Zone

Table C-2. Site Content Summary (see text for definitions, second section).

Site * 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic** EP	EM	LM	LP	HA	UA	NH
5	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	+	?
7	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	+	?	?	+
8	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	+	?
9	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	+	?
11	Unkn.	Low	Unkn.	Frag.	Unknown	Unkn.	?	?	?	?	?	+	?
12	Unkn.	Unknown	Unkn.	Frag.	Unknown	Unkn.	?	?	?	?	?	+	?
47	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
188	Med.	Medium	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
189	Med.	Low	Pres.	Abst.	Absent	Abst.	-	+	+	-	-	-	-
190	Low	V.High	Med.	Frag.	Absent	Pres.	-	+	+	-	-	-	+
191	Low	High	Low	Frag.	Absent	Abst.	-	-	-	+	-	-	-
193	Low	Low	Low	Both	Tine	Abst.	-	-	+	-	-	-	-
364	Med.	Low	High	Both	Tine	Abst.	+	+	+	+	-	-	-
365	Med.	Low	High	Frag.	Absent	Abst.	-	+	-	+	-	-	-
366	High	V.High	High	Both	Bon/Shl	Pres.	-	-	-	+	-	-	+
367	Abst.	Low	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
368	Abst.	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
369	High	Low	Low	Frag.	Absent	Pres.	+	-	+	-	-	-	+
370	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
371	Low	Low	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
372	Low	Low	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
373	Med.	V.High	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
374	Low	Absent	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
375	Med.	Low	Low	Both	Absent	Abst.	-	-	+	-	-	-	-
376	Med.	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
377	Abst.	Absent	Abst.	Frag.	Absent	Pres.	-	-	-	-	-	-	+
378	Med.	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
380	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
381	Low	Low	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
382	Low	Low	Low	Abst.	Absent	Pres.	-	+	-	-	-	-	+
383	Low	Medium	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
384	High	Low	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
385	Med.	Medium	Med.	Both	Absent	Abst.	-	-	-	-	-	+	-
386	Med.	Low	High	Both	Absent	Pres.	-	+	-	+	-	-	+
387	Med.	Medium	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
388	High	V.High	High	Both	Absent	Pres.	-	+	+	-	-	-	+
389	Low	Absent	Low	Both	Absent	Abst.	-	-	+	-	-	-	-
390	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
391	High	Absent	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
392	High	High	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
393	Low	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
394	Med.	Medium	High	Frag.	Absent	Abst.	+	-	-	-	-	-	-
395	Low	Absent	Pres.	Abst.	Absent	Pres.	-	-	-	-	-	+	+

Table C-2. (Continued)

Site* 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic** EP	EM	LM	LP	HA	UA	NH
396	Med.	High	Med.	Frag.	Absent	Pres.	-	-	-	-	-	+	+
397	Low	Medium	High	Abst.	Absent	Pres.	-	-	-	+	-	-	+
398	Med.	Absent	Low	Frag.	Absent	Abst.	-	-	-	+	-	-	-
399	Med.	Low	High	Frag.	Absent	Abst.	-	-	-	+	-	-	-
400	Low	Medium	Med.	Frag.	Absent	Abst.	-	+	+	-	-	-	-
401	Abst.	Absent	Abst.	Frag.	Absent	Pres.	-	-	-	-	-	-	+
402	High	Absent	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
403	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
404	Low	Low	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
405	Med.	Absent	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
406	Med.	Absent	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
407	Low	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
408	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
409	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
410	Low	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
411	Low	Low	High	Frag.	Absent	Abst.	-	-	-	-	-	+	-
412	Low	Low	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
413	Low	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
414	Abst.	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
415	Low	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
416	Low	High	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
417	Med.	V.High	High	Frag.	Absent	Abst.	-	-	-	+	-	-	-
418	Low	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
419	Low	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
420	Low	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
421	Low	Medium	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
422	Low	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
423	High	Medium	High	Frag.	Absent	Pres.	-	-	-	+	-	-	+
424	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
425	Med.	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
426	Low	Low	High	Frag.	Absent	Pres.	-	-	-	-	-	+	+
427	Low	High	Med.	Both	G.Bead	Pres.	-	-	-	-	+	+	+
428	Abst.	Absent	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
429	High	Medium	High	Both	Absent	Pres.	-	+	-	-	-	-	+
430	Med.	Low	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
431	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
432	Med.	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
433	Abst.	Absent	Pres.	Frag.	Absent	Pres.	-	-	-	-	-	+	+
434	Unkn.	Absent	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
435	Low	Absent	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
436	High	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
437	Med.	Absent	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
438	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-

Table C-2. (Continued)

Site* 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic** EP	EM	LM	LP	HA	UA	NH
439	Low	Low	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
440	Low	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
441	Low	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
442	Low	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
443	Med.	Low	High	Frag.	G.Bead	Abst.	-	-	+	+	+	-	-
444	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
445	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
446	Low	Low	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
447	High	Absent	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
448	Abst.	Low	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
449	Low	Absent	High	Frag.	Absent	Abst.	-	-	-	-	-	+	-
451	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
452	Low	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
487	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
488	High	Absent	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
501	Unkn.	Unknown	Pres.	Ided.	Absent	Abst.	-	-	+	-	-	-	-
502	Unkn.	Low	Pres.	Frag.	Absent	Abst.	-	-	+	+	-	-	-
503	Unkn.	Unknown	Pres.	Unkn.	Absent	Abst.	-	+	+	-	-	-	-
504	Unkn.	Unknown	Unkn.	Unkn.	Absent	Abst.	-	-	+	-	-	-	-
505	Low	Absent	Abst.	Abst.	Absent	Abst.	-	-	+	-	-	-	-
506	High	Unknown	Unkn.	Unkn.	Absent	Abst.	-	-	-	-	-	+	-
507	Abst.	Low	High	Both	Absent	Abst.	-	-	-	-	-	+	-
508	Unkn.	Unknown	Unkn.	Ided.	Absent	Abst.	-	-	-	-	-	+	-
509	Unkn.	Unknown	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
510	Abst.	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
512	Unkn.	Unknown	Unkn.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
513	Unkn.	Unknown	Pres.	Both	Metal	Abst.	-	+	+	+	+	-	-
514	Unkn.	Unknown	Unkn.	Unkn.	Absent	Abst.	-	-	-	-	-	+	-
515	Unkn.	Unknown	High	Unkn.	Absent	Pres.	-	-	-	-	-	+	+
516	Unkn.	Unknown	Pres.	Both	Absent	Abst.	-	-	-	-	-	+	-
517	Unkn.	Medium	Pres.	Frag.	Pipe	Pres.	-	+	+	+	-	-	+
518	Unkn.	Low	Pres.	Unkn.	Absent	Abst.	-	-	-	-	-	+	-
520	Low	Medium	High	Frag.	Absent	Abst.	-	-	+	-	-	-	-
521	Abst.	Absent	Abst.	Frag.	G.Bead	Pres.	-	-	-	-	+	-	+
522	Low	Unknown	Low	Abst.	Absent	Abst.	-	-	+	-	-	-	-
523	Abst.	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	+
524	Low	Unknown	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
525	Abst.	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
530	Abst.	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
651	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
652	Low	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
653	Low	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
654	Abst.	Low	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-

Table C-2. (Continued)

Site* 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic** EP	EM	LM	LP	HA	UA	NH
655	Abst.	Absent	Low	Ided.	Absent	Pres.	-	-	-	-	-	-	+
656	Med.	V.High	High	Both	Absent	Pres.	-	+	-	+	-	-	+
657	Abst.	Absent	Low	Ided.	Absent	Pres.	-	-	-	-	-	-	+
658	Abst.	Absent	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
659	Abst.	Low	Low	Abst.	Absent	Pres.	-	-	-	-	-	+	+
660	Abst.	Low	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
661	Unkn.	Low	High	Both	Absent	Pres.	-	-	-	-	-	+	+
662	Abst.	Absent	High	Frag.	Absent	Pres.	-	-	-	-	-	+	+
663	Abst.	Absent	High	Ided.	Absent	Abst.	-	-	-	-	-	+	-
664	Abst.	Absent	Low	Ided.	Absent	Pres.	-	-	-	-	-	+	+
665	Low	Low	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
666	Med.	Low	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
667	Abst.	Low	High	Both	Absent	Abst.	-	-	-	-	-	+	-
668	Abst.	Absent	Med.	Ided.	Absent	Abst.	-	-	-	-	-	+	-
669	Low	Absent	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
670	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
671	Unkn.	Low	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
672	Abst.	Absent	Low	Ided.	Absent	Pres.	-	-	-	-	-	+	+
673	Med.	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
674	Low	Absent	Low	Both	Absent	Pres.	-	-	-	-	-	+	+
675	Low	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
676	Low	Low	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
677	High	Low	Low	Both	Absent	Pres.	-	-	+	-	-	-	+
678	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
679	Low	Medium	High	Both	Absent	Abst.	-	-	-	-	-	+	-
680	Low	Absent	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
681	Med.	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
682	Unkn.	Low	Low	Frag.	Absent	Pres.	+	+	-	-	-	-	+
683	Abst.	Low	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
684	Low	Low	Low	Ided.	Absent	Abst.	-	-	-	+	-	-	-
685	Abst.	Absent	Low	Ided.	Absent	Pres.	-	-	-	-	-	-	+
686	Low	Low	High	Both	Absent	Abst.	-	-	-	-	-	+	-
687	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
688	Low	Low	High	Frag.	Absent	Abst.	-	-	+	+	-	-	-
689	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
690	Low	V.High	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
691	Low	Low	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
692	Med.	Low	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
693	Unkn.	Absent	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
694	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
695	Low	Absent	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
696	Low	Absent	Low	Ided.	Absent	Abst.	-	-	-	-	-	+	-
697	Low	Medium	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+

Table C-2. (Continued)

Site* 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic** EP	EM	LM	LP	HA	UA	NH
698	Low	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
699	Low	Absent	Low	Frag.	Absent	Abst.	-	-	+	+	-	-	-
700	Abst.	Low	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
701	Abst.	Absent	Abst.	Both	Absent	Pres.	-	-	-	-	-	-	+
702	Med.	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
703	Low	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	-
704	High	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
705	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
706	Low	Low	Med.	Frag.	Absent	Pres.	-	-	+	+	-	-	+
707	Low	Low	Med.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
708	Low	Low	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
709	Low	Low	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
710	Abst.	Low	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
711	Low	High	Med.	Both	Absent	Abst.	-	-	+	+	-	-	-
712	Med.	Absent	Med.	Abst.	Absent	Abst.	-	+	+	-	-	-	-
713	Low	High	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
714	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
715	Unkn.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	+	-	-	+
716	Abst.	Low	High	Ided.	Absent	Abst.	-	-	-	-	-	+	-
1052	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	+	?
1053	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1054	High	V.High	High	Both	Metal	Abst.	+	+	+	+	+	-	-
1055	High	Medium	High	Frag.	Absent	Abst.	-	+	-	-	-	-	-
1056	Med.	Present	High	Frag.	Absent	Abst.	-	-	-	+	-	-	-
1057	Med.	Unknown	Pres.	Unkn.	Absent	Abst.	-	-	-	-	-	+	-
1058	High	V.High	High	Frag.	Absent	Abst.	-	+	+	+	-	-	-
1059	High	Absent	Low	Frag.	Absent	Abst.	-	+	-	+	-	-	-
1060	High	Low	Med.	Frag.	Absent	Abst.	-	+	+	-	-	-	-
1061	Med.	Absent	Med.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1062	Unkn.	Unknown	Unkn.	Unkn.	Absent	Abst.	?	?	?	?	?	+	-
1063	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1064	Unkn.	Absent	Low	Unkn.	Unknown	Unkn.	?	+	?	?	?	?	?
1065	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1066	Low	Absent	Low	Abst.	Absent	Abst.	-	+	-	-	-	-	-
1067	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1068	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1069	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1070	Low	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
1072	Low	Absent	Low	Both	Absent	Abst.	-	-	-	+	-	-	-
1073	High	V.High	High	Both	Absent	Pres.	+	+	+	+	-	-	+
1074	High	V.High	High	Both	Absent	Abst.	-	+	+	+	-	-	-
1075	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	+	-	-	-
1076	High	Medium	High	Both	Absent	Abst.	-	-	-	-	-	+	-

Table C-2. (Continued)

Site 24LN----	Lith. Den.	Den.FCR Feature	FCR Den.	Bone Type	Rare Art.	Hist. Art.	Cult/Chrn.Diagnostic EP	EM	LM	LP	HA	UA	NH
1077	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1078	Unkn.	Absent	Pres.	Frag.	Absent	Abst.	-	-	-	-	-	+	-
1079	Low	Unknown	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1080	Low	Absent	Low	Frag.	Absent	Abst.	-	-	-	-	-	+	-
1081	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1082	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1083	Low	Absent	Abst.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1084	Low	Absent	Low	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1085	Low	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1086	Unkn.	Absent	High	Abst.	Bon/Shl	Abst.	-	+	+	-	-	-	-
1087	Unkn.	Absent	Pres.	Both	Absent	Pres.	-	-	-	-	-	+	+
1089	Abst.	Absent	Pres.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1090	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1091	Abst.	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1092	Low	Low	High	Both	Absent	Pres.	-	-	-	-	-	+	+
1093	Low	Absent	Pres.	Frag.	Absent	Pres.	-	-	-	-	-	+	+
1094	Low	Absent	Low	Abst.	Absent	Pres.	-	-	+	-	-	-	+
1095	Med.	Absent	Low	Frag.	Absent	Pres.	-	-	-	-	-	+	+
1096	Low	Absent	Low	Both	Absent	Abst.	-	-	-	-	-	+	-
1097	Low	Low	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
1098	Low	Absent	Pres.	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1099	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	+	+
1100	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1101	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	+	+
1102	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1103	Abst.	Absent	Abst.	Abst.	Absent	Pres.	-	-	-	-	-	-	+
1142	Unkn.	Unknown	Unkn.	Unkn.	Absent	Pres.	?	?	?	?	?	?	+
1143	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1144	Med.	Low	Med.	Both	Absent	Pres.	-	-	-	-	-	+	+
1146	Low	Low	High	Abst.	Absent	Abst.	-	-	-	-	-	+	-
1147	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1148	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	+	?
1149	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?
1150	Unkn.	Unknown	Unkn.	Unkn.	Unknown	Unkn.	?	?	?	?	?	?	?

*General Key for abbreviations:

Den. : Density
Art. : Artifacts
Lith. : Lithic
FCR : Fire-Cracked Rock
Hist. : Historic
Unkn. : Unknown
Abst. : Absent
Med. : Medium
V.High : Very High
Pres. : Present
Frag. : Fragment
Tine : Antler Tine Tool
Bon/Shl : Bone or Shell Artifact
G.Bead : Glass Bead

**Key for Cultural/Chronological (Cult/Chron.) Diagnostic

EP : Early Prehistoric Period
EM : Early Middle Prehistoric Period
LM : Late Middle Prehistoric Period
LP : Late Prehistoric Period
HA : Historic Aboriginal Period
UA : Unknown Aboriginal Period
NH : Nonaboriginal Historic Period
- : Absent
+ : Present
? : Unknown

Table C-3. Descriptive and Locational Information for Isolated Artifact Finds.

Isolated Artifact Number	Artifact Description: Classification	Artifact Description: Material type	Nearest site* (distance in meters)	Locational Setting: Reservoir segment	Distance to perm. water source (m)	Solar expo-sure	Terrace setting (elevation)	Landform type	Comments
IA-1	Projectile point (small, corner notched and barbed)	Black, fine grain, mudstone	371 (245)	Lower Canyon	245	west	T-6 (2400')	Bar/ Terrace	Part of the base of the artifact is missing; artifact is from the Stuck Truck Complex area.
IA-2	Flake	Black, opaque chert	522 (195)	Tobacco Plains	1280	West	T-8 (2460')	Bar/ Terrace	Artifact is from an area 1.7 km southwest of the Tobacco River.
IA-3	Bottle (special Battery Oil container made by T. Edison Inc.)	Green translucent glass	New Rexford (170)	Tobacco Plains	1120	North-west	T-9 (2580')	Bar/ Terrace	Artifact is from an area 0.2 km east of New Rexford.
IA-4	Projectile point (large, corner notched and barbed)	Black, translucent chert	190 (40)	Tobacco Plains	50	West	T-5 (2415')	Bar/ Terrace	Part of the base is missing; artifact is from an area immediately north of the Tobacco River.
IA-5	Flake	Red, medium grain quartzite	695 (805)	Upper Canyon	390	East	T-4 (2360')	Fan/ debris Flow	Artifact is from an area 4.5 km north of Parsnip Creek.
IA-6	Flake	*Black, very fine* grain mudstone	1057 (535)	Lower Canyon	180	South-west	T-8 (2525')	Bar/ Terrace	Artifact is from the Bristow Creek Complex area.
IA-7	Projectile point (large, corner notched and bar bed)	White, opaque chert	441 (575)	Tobacco Plains	660	South-west	T-5 (2430')	Bar/ Terrace	Part of the tip end is missing; artifact is from the southeast corner of the Kootenai Flat area.
IA-8	Large cobble and a fire cracked rock (?)	Quartzite (both specimens)	501 (245)	Lower Canyon	100	South	T-8 (2460')	Bar/ Terrace	These possible artifacts are from very sandy sediments and their presence is probably cultural; from north of Jackson Creek.
IA-9	Bottle *(rim fragment)*	*Green,* translucent glass	366 (75)	Tobacco Plains	20	West	T-4 (2420')	Terrace Slope	Artifact is from the northeastern corner of the Kootenai Flat area.
IA-10	Flakes (4)	2 Red quartzite 2 black fine grain mudstone	702 (685)	Lower Canyon	245	East	T-8 (2460')	Bar/ Terrace	Artifacts (not collected) are from an area 1.3 km south of Jackson Creek.
IA-11	Possible battered stone (one face, mortar-like)	Granitic	708 (1340)	Lower Canyon	245	East	T-5 (2360')	Terrace Slope	Artifact (not collected) is from an area 1.3 km south of Peace Creek.
IA-12	Probable worked tine (flaking tool?)	Antler *(deer)*	387 (390)	Lower Canyon	170	East	T-5 (2375')	Terrace Slope	This probable artifact is from an area 0.9 km north of Barron Creek.

Table C-3. (Continued)

Isolated Artifact Number	Artifact Description: Classification	Material type	Nearest site* (distance in meters)	Locational Setting: Reservoir segment	Distance to perm. water source (m)	Solar exposure	Terrace setting (elevation)	Landform type	Comments
IA-13a	Projectile point (large, corner to side notched)	Grey, opaque chert	12 (390)	Upper Canyon	440	West	T-6 (2435')	Bar/ Terrace	Part of the base is missing; artifact is from an area 1.2 km north of Sutton Creek; it was found with IA-13b.
IA-13b	Flake	Black, fine grain mudstone	12 (390)	Upper Canyon	440	West	T-6 (2435')	Bar/ Terrace	Artifact, together with IA-13a, are from an area 1.2 km north of Sutton Creek.
IA-14	Edge modified flake (unifacial, multiple edges)	Grey, slightly translucent chert	1030 (1185)	Upper Canyon	100	North-west	T-9 (2460')	Kame Terrace	Artifact is from an area immediately north of Big Creek.
IA-15	Flake	Black, fine grain mudstone	389 (120)	Upper Canyon	425	East	T-5 (2370')	Fan/ Debris Flow	Artifact (not collected), along with IA-16, is from an area 0.4 km north of Parsnip Creek.
IA-16	Flake	Black, fine grain mudstone	389 (120)	Upper Canyon	425	East	T-5 (2370')	Fan/ Debris Flow	Artifact (not collected), along with IA-15, is from an area 0.4 km north of Parsnip Creek.
IA-17	Flake (1) and fire cracked rock (3)	Grey mudstone (flake) and quartzite (FCR)	510 (1340)	Lower Canyon	35	East	T-7 (2430')	Bar/ Terrace	Artifacts (not collected) are from an area immediately north of Little Jackson Creek.
IA-18	Edge modified flake (end scraper)	Black, slightly translucent chert	420 (100)	Tobacco Plains	610	North	T-6 (2430')	Bar/ Terrace	Artifact is from the south Tobacco River Complex area.
IA-19	Projectile point (large, indented base)	Grey-green, very fine grain mudstone	516 (975)	Tobacco Plains	1135	East	T-6 (2430')	Terrace Slope	A small part of the tip end is missing; artifact is from an area 1.1 km north of Dodge Creek.
IA-20	Shatter	Black, fine grain mudstone	383 (5809)	Upper Canyon	75	South-east	T-8 (2455')	Bar/ Terrace	Artifact (not collected), along with IA-21, is from an area immediately north of Ural Creek.
IA-21	Possible battered stone (edge battered, hammer-stone)	Quartzite	383 (5800)	Upper Canyon	75	South-east	T-8 (2455')	Bar/ Terrace	Artifact (not collected), along with IA-20, is from an area immediately north of Ural Creek.
IA-22	Projectile point (medium, corner to side notched)	Black, slightly translucent chert	433 (170)	Tobacco Plains	490	South-west	T-4 (2400')	Dune	Artifact is complete; it is from the east-central area of Kootenai Flat.

Table C-3. (Continued)

Isolated Artifact Number	Artifact Description: Classification	Material type	Nearest site* (distance in meters)	Locational Setting: Reservoir segment	Distance to perm. water source (m)	Solar exposure	Terrace setting (elevation)	Landform type	Comments
IA-23	Possible flakes (3), possible core (1)	2 black mudstone, 1 quartzite flake, red quartzite core	520 (730)	Tobacco Plains	195	West	T-5 (2415')	Bar/ Terrace	These possible artifacts (not collected) are from an area 0.7 km north of Pinkham Creek.
IA-24	Edge modified flake (pointed end)	Brown, fine grain mudstone	678 (425)	Tobacco Plains	185	North	T-9 (2500')	Terrace Slope	Artifact is from an area immediately north of the Tobacco River.
IA-25	Edge modified flake (two margins)	Black, fine grain mudstone	1066 (50)	Lower Canyon	855	North-east	T-8 (2440')	Terrace Slope	Artifact is from an area 1.3 km north of Cripple Horse Creek.
IA-26	Edge modified flake (alternate margins)	Brown, very fine grain mudstone	371 (35)	Lower Canyon	1100	West	T-6 (2375')	Bar/ Terrace	Artifact is from an area 1.5 km south of Cripple Horse Creek.
IA-27	Possible flake	Grey, medium grain quartzite	433 (365)	Tobacco Plains	450	South-west	T-4 (2400')	Dune	Artifact is from the east-central area of Kootenai Flat.
IA-28	Flake	Red, medium grain quartzite	666 (30)	Tobacco Plains	20	South-west	T-4 (2380')	Dune	Artifact is from the east-central Kootenai Flat area, Near to but across the creek from the Sophie Creek Dune Complex.
IA-29	Biface I (pointed end)	Black, fine grain mudstone	711 (30)	Lower Canyon	660	South-east	T-7 (2445')	Bar/ Terrace	Artifact is from the McGillivrary Complex area.
IA-30	Possible flake	Grey, medium grain quartzite	689 (50)	Upper Canyon	440	South-west	T-7 (2455')	Fan/ debris Flow	This possible artifact, along with IA-32 and 33, is from the North Ten Mile Creek Complex area.
IA-31	Flake	Black, fine grain mudstone	689 (25)	Upper Canyon	365	South-west	T-7 (2445')	Fan/ debris Flow	Artifact is from the North Ten Mile Creek Complex area.
IA-32	Flake	Black, fine grain mudstone	689 (50)	Upper Canyon	440	South-west	T-7 (2455')	Fan/ debris Flow	Artifact, along with IA-30 and 33, is from the North Ten Mile Creek Complex area.
IA-33	Shatter	Grey, medium grain quartzite	689 (50)	Upper Canyon	440	South-west	T-7 (2455')	Fan/ debris Flow	Artifact, along with IA-30 and 32 is from the North Ten Mile Creek Complex area.
IA-34	Pendant (triangular in shape)	Shell (marine?)	660 (40)	Tobacco Plains	680	South-west (full)	T-4 (2395')	Dune	This complete specimen is from the central Kootenai Flat area.

Table C-3. (Continued)

Isolated Artifact Number	Artifact Description: Classification	Material type	Nearest site* (distance in meters)	Locational Setting: Reservoir segment	Distance to perm. water source (m)	Solar exposure	Terrace setting (elevation)	Landform type	Comments
IA-35	Possible flakes (2)	Black, fine grain mudstone	1083 (6100)	Tobacco Plains	610	East	T-9 (2460')	Kame Terrace	These possible artifacts (not collected) are from an area 2 km south of Sullivan Creek.
IA-36	Biface I	Black, fine grain mudstone	702 (90)	Lower Canyon	535	East	T-8 (2460')	Bar/ Terrace	Artifact is from an area 0.6 km southwest of Jackson Creek.
IA-37	Biface IV (pointed end fragment)	Brown, fine grain mudstone	679 (120)	Lower Canyon	75	South	T-8 (2470')	Bar/ Terrace	Artifact is from the high terrace on the north side of Canyon Creek.
IA-38	Core (partial cobble core, multidirectional)	Brown, fine grain mudstone	679 (85)	Lower Canyon	100	South	T-6 (2380')	Terrace Slope	Artifact is from the edge of a tributary to Canyon Creek.
IA-39	Flake	Grey, medium grain quartzite	707 (780)	Lower Canyon	340	West	T-8 (2460')	Fan/ debris Flow	Artifact, along with IA-40, 41, and 42, is from an area immediately south of Five Mile Creek.
IA-40	Flake	Red, coarse grain quartzite	707 (780)	Lower Canyon	340	West	T-8 (2460')	Fan/ debris Flow	Artifact, along with IA-39, 41, and 42, is from an area immediately south of Five Mile Creek.
IA-41	Flake	Red, coarse grain quartzite	707 (780)	Lower Canyon	340	West	T-8 (2460')	Fan/ debris Flow	Artifact, along with IA-39, 40, and 42, is from an area immediately south of Five Mile Creek.
IA-42	Core (partial cobble core, unidirectional)	Red, coarse grain quartzite	707 (780)	Lower Canyon	340	West	T-8 (2460')	Fan/ debris Flow	Artifact along with IA-39, 40, and 41, is from an area immediately south of Five Mile Creek.
IA-43	Large, hafted biface (corner notched with wide tang width)	Brown, opaque chert	689 (50)	Upper Canyon	35	South	T-7 (2430')	Fan/ debris Flow	Artifact is from the North Ten Mile Creek Complex area.
IA-44	Projectile point (large, lanceolate and leaf shaped)	Brown, opaque chert	707 (175)	Lower Canyon	30	South	T-8 (2465')	Fan/ debris Flow	Part of the tip and base ends are missing and the artifact is burned; it, along with IA-45 and 46, is from the north side of Five Mile Creek.
IA-45	Flake	Red, medium grain quartzite	707 (175)	Lower Canyon	30	South	T-8 (2465')	Fan/ debris Flow	Artifact, along with IA-44 and 46, is from the north side of Five Mile Creek.
IA-46	Flake	Black, very fine grain mudstone	707 (175)	Lower Canyon	30	South	T-8 (2465')	Fan/ debris Flow	Artifact, along with IA-44 and 45, is from the north side of Five Mile Creek.

*All site numbers are preceded by 24LN...; the nearest historic site is listed when the IA is of nonaboriginal manufacture and when the IA is of probable aboriginal manufacture, the nearest site listed is aboriginal.

Aboriginal Sites (see text for definitions, Chapter 6, third section).

Site No. 24LN----	Number of Items by Morpho-Functional Types									
	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
5	*									
7										
8										
9										
11										
12										
47										
188	** 0	0	0	2	0	0	0	0	0	0
189	1	0	0	0	0	4	0	0	3	0
190	0	24	1	0	0	3	1	0	0	0
191	0	0	0	1	1	0	1	0	0	0
193	3	0	1	3	0	1	5	3	0	0
364	4	336	3	4	1	3	10	2	2	0
365	4	364	1	1	2	2	4	0	9	0
366	0	328	1	2	1	1	9	2	0	0
367	0	0	0	0	0	0	0	0	0	0
368	0	0	0	0	0	0	0	0	0	0
369	0	273	0	0	0	3	1	0	1	0
370										
371	0	2	0	0	0	0	0	1	0	0
372	0	5	0	0	0	0	0	1	3	1
373	0	30	0	0	0	0	2	1	0	0
374	0	0	0	0	0	0	0	1	0	0
375	0	24	0	2	0	1	1	0	1	0
376	0	7	1	0	0	1	0	1	1	0
377										
378	0	12	0	0	0	0	2	0	0	0
380										
381	0	0	1	0	0	0	0	0	0	0
382	2	0	0	0	0	1	0	0	0	0
383	0	0	0	0	0	0	1	0	0	0
384	0	89	0	0	0	0	1	0	0	0
385	4	336	0	2	0	1	5	3	3	0
386	2	83	0	2	1	2	2	1	4	0
387	5	12	1	3	0	1	9	3	2	0
388	17	324	2	7	0	9	13	13	5	0
389	0	0	0	0	0	1	1	0	0	0
390										
391	1	6	0	0	0	0	0	0	0	0
392	0	527	0	4	0	0	4	2	0	0
393	0	1	0	0	0	0	1	0	0	0
394	2	56	2	3	0	2	1	0	1	0
395	0	1	0	0	0	0	0	1	0	0

Table C-4. (Continued)

Site No. 24LN----	Number of Items by Morpho-Functional Types									
	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
396	0	62	0	1	0	1	1	0	2	2
397	0	0	0	0	1	0	0	0	0	0
398	0	0	0	0	1	0	0	0	0	0
399	0	9	1	1	1	1	0	0	0	0
400	0	45	0	0	0	3	1	0	0	0
401										
402	0	163	0	2	0	0	2	0	0	0
403										
404										
405										
406										
407										
408										
409										
410	0	0	0	0	0	0	0	1	0	0
411										
412										
413										
414	0	0	0	0	0	0	0	0	0	0
415										
416	0	4	0	0	0	0	1	0	0	0
417	0	227	0	1	4	0	1	0	2	0
418	0	8	0	0	0	0	0	1	0	0
419	0	5	2	0	0	0	0	0	0	1
420	0	0	0	0	0	0	1	0	0	0
421	0	0	0	0	0	0	1	0	0	0
422	0	0	0	0	0	0	1	0	1	0
423	1	84	1	1	0	1	1	1	1	0
424										
425	0	0	0	0	0	0	1	0	0	0
426										
427	0	24	0	0	0	0	0	0	0	1
428	0	0	0	0	0	0	0	0	0	0
429	0	1029	0	0	0	3	1	0	0	0
430										
431	0	0	0	0	0	0	0	0	0	0
432	0	22	0	0	0	0	0	0	0	0
433	0	0	0	0	0	0	0	0	0	0
434										
435										
436										
437										
438	0	0	0	0	0	0	0	0	0	0

Table C-4. (Continued)

Site No. 24LN----	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
	Number of Items by Morpho-Functional Types									
439										
440										
441	0	4	0	1	0	0	0	0	0	0
442										
443	0	151	0	3	1	1	3	0	0	0
444										
445										
446	0	1	0	0	0	0	0	0	0	0
447	0	97	0	0	0	0	2	0	0	0
448	0	0	0	0	0	0	0	0	0	0
449										
451										
452										
487	0	0	0	0	1	0	1	0	0	0
488	0	40	0	0	0	0	3	0	1	0
501										
502										
503										
504										
505										
506										
507										
508										
509										
510										
512										
513										
514										
515	0	0	0	0	0	0	0	0	1	0
516										
517										
518										
520										
521										
522										
523										
524										
525										
530										
651										
652	1	0	0	0	0	0	0	0	0	0
653	0	1	0	0	0	0	0	0	0	0
654	0	0	0	0	0	0	0	0	0	0

Table C-4. (Continued)

Site No. 24LN----	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
	Number of Items by Morpho-Functional Types									
655										
656	3	311	2	3	1	1	5	3	5	1
657										
658	0	0	0	0	0	0	0	0	0	0
659	0	0	0	0	0	0	0	0	0	0
660	0	0	0	0	0	0	0	0	0	0
661	0	7	0	0	0	0	2	1	0	0
662	0	0	0	0	0	0	0	0	0	0
663	0	0	0	0	0	0	0	0	0	0
664	0	0	0	0	0	0	0	0	0	0
665	1	45	0	1	0	0	0	0	1	0
666	1	15	0	1	0	0	2	0	0	0
667	0	0	0	0	0	0	0	0	0	0
668	0	0	0	0	0	0	0	0	0	0
669										
670										
671	1	3	0	0	0	0	0	0	0	0
672	0	0	0	0	0	0	0	0	0	0
673	0	20	0	0	0	0	1	0	0	0
674	0	1	0	0	0	0	0	0	0	0
675	0	45	0	0	0	0	0	2	0	0
676	1	0	0	0	0	0	0	0	0	0
677	0	159	0	1	0	1	3	0	0	0
678	0	0	0	0	0	0	0	0	0	0
679	0	14	0	0	0	0	3	0	0	0
680										
681										
682	0	3	0	0	0	2	0	0	0	0
683	0	0	0	0	0	0	0	0	0	0
684	0	0	0	0	1	0	0	0	0	0
685										
686	0	4	0	0	0	0	0	1	1	0
687										
688	0	0	0	0	1	1	0	0	0	0
689	0	0	0	0	0	0	0	0	0	0
690	0	2	0	0	0	0	0	0	0	0
691	1	4	0	0	0	0	0	0	0	0
692	2	33	0	1	0	0	0	0	1	0
693										
694	0	0	0	0	0	0	0	0	0	0
695	0	2	0	0	0	0	0	0	0	0
696	0	0	0	0	0	0	0	0	1	0
697	0	0	0	1	0	0	0	0	0	0

Table C-4. (Continued)

Site No. 24LN----	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
	Number of Items by Morpho-Functional Types									
698	0	0	0	0	0	0	0	1	1	0
699	0	0	0	0	1	1	0	0	0	0
700	0	0	0	0	0	0	0	0	0	0
701										
702	0	8	0	0	0	0	0	0	0	0
703										
704	1	1194	1	1	0	0	4	0	0	0
705										
706	0	35	0	0	2	3	2	0	4	0
707	0	179	0	0	0	0	3	0	0	0
708	0	8	0	0	0	0	0	0	1	0
709	0	9	0	0	0	0	0	0	0	0
710	0	0	0	0	0	0	0	0	0	0
711	0	19	0	1	1	2	3	0	0	0
712	0	73	0	0	0	2	4	0	1	0
713										
714										
715	0	10	0	0	1	0	1	0	0	0
716	0	0	0	0	0	0	0	0	0	0
1052	0	1	0	0	0	0	0	0	2	0
1053										
1054	64	18235	30	107	12	48	231	71	51	1
1055	2	120	3	6	0	2	3	3	6	0
1056	0	5	0	1	1	0	3	1	1	0
1057	5	44	1	0	0	0	2	0	0	0
1058	7	2496	3	6	1	3	18	5	4	0
1059	7	176	2	8	1	2	7	3	2	0
1060	5	384	1	5	0	4	16	5	4	0
1061										
1062	0	0	0	0	0	0	0	0	2	0
1063										
1064	0	0	0	0	0	1	1	1	0	0
1065										
1066	0	2	0	0	0	1	0	0	1	0
1067										
1068										
1069										
1070	0	0	0	1	0	0	0	0	0	0
1072	0	0	0	0	1	0	0	0	1	0
1073	25	1358	7	20	7	14	41	12	7	2
1074	4	308	1	3	3	8	15	0	1	0
1075	0	0	0	0	1	0	0	0	0	0
1076	0	48	0	2	0	0	1	3	1	0

Table C-4. (Continued)

Site No. 24LN----	Cores	Flake Shat.	Rough Bif.	Thin Bif.	Arrow Point	Dart Point	Thin Edge	Thick Edge	Non-Flake	Net Weight
	Number of Items by Morpho-Functional Types									
1077	0	0	0	0	0	0	0	0	0	0
1078										
1079										
1080	2	4	0	0	0	0	0	0	1	0
1081	0	0	0	0	0	0	1	0	0	0
1082										
1083										
1084										
1085										
1086	0	7	1	2	0	2	3	0	0	0
1087	0	399	2	1	0	2	11	1	0	0
1089										
1090										
1091	0	0	0	0	0	0	0	0	0	0
1092										
1093										
1094	0	0	0	0	0	1	0	0	0	0
1095										
1096	0	0	0	1	0	0	0	0	0	0
1097	0	12	0	0	0	1	2	0	0	0
1098										
1099										
1100										
1101										
1102										
1103										
1142										
1143										
1144	0	105	1	0	0	0	3	0	0	0
1146	0	0	0	0	0	0	0	0	1	0
1147										
1148	0	0	0	0	0	0	0	0	0	1
1149										
1150										
Total	179		73	219	50	148	486	151	144	10
IA	2		2	2	1	6	5			
Total	181	30723	75	221	51	154	491	151	144	10

* Blank spaces in the table indicate that collections were not made.
**Zeros (0s) in the table indicate that collections were made but did not include the particular kind of artifact.

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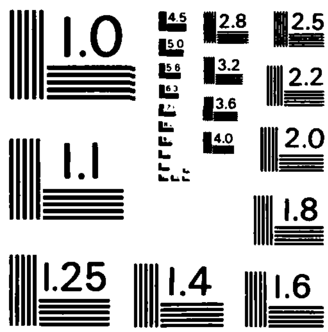

MICROCOPY RESOLUTION TEST CHART
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Table C-5. Site by Site Tabulation of the Broad Characteristics of Cultural Resources in the Lake Koocanusa Project Area (see text for definitions, Chapter 6, fourth section).

Site No 24LN----	Site Condition	Site Size	Site Depth	Site Type
5	Unknown	Large	Unknown	Missing Data
7	Unknown	Large	Unknown	Missing Data
8	Unknown	Large	Greater than 30 cm	Missing Data
9	Unknown	Large	Unknown	Missing Data
11	Unknown	Small	Unknown	Missing Data
12	Unknown	Unknown	Greater than 30 cm	Missing Data
47	Unknown	Small	Unknown	Historic Structure
188	Poor	Medium	Less than 30 cm	Low Diversity
189	Fair	Small	Less than 30 cm	Low Diversity
190	Fair	Medium	Less than 30 cm	Low Diversity
191	Poor	Medium	Less than 30 cm	Low Diversity
193	Poor	Medium	Unknown	High Diversity
364	Fair	Medium	Less than 30 cm	High Diversity
365	Destroyed	Medium	Unknown	High Diversity
366	Poor	Large	Greater than 30 cm	High Diversity
367	Destroyed	Small	Unknown	FCR and Bone
368	Poor	Small	Unknown	FCR and Bone
369	Fair	Medium	Less than 30 cm	Low Diversity
370	Good	Large	Unknown	Historic Structure
371	Poor	Medium	Unknown	Low Diversity
372	Poor	Medium	Unknown	Low Diversity
373	Fair	Medium	Greater than 30 cm	Low Diversity
374	Fair	Small	Unknown	Low Diversity
375	Good	Medium	Greater than 30 cm	High Diversity
376	Poor	Small	Unknown	High Diversity
377	Good	Medium	Unknown	Historic Structure
378	Fair	Small	Unknown	Low Diversity
380	Good	Large	Unknown	Historic Structure
381	Poor	Medium	Unknown	Low Diversity
382	Good	Medium	Unknown	Low Diversity
383	Destroyed	Small	Unknown	Low Diversity
384	Fair	Small	Greater than 30 cm	Low Diversity
385	Fair	Large	Greater than 30 cm	High Diversity
386	Fair	Medium	Less than 30 cm	High Diversity
387	Poor	Medium	Less than 30 cm	High Diversity
388	Fair	Large	Less than 30 cm	High Diversity
389	Fair	Small	Unknown	Low Diversity
390	Poor	Small	Unknown	Historic Debris
391	Poor	Small	Unknown	Low Diversity
392	Fair	Large	Less than 30 cm	Low Diversity
393	Poor	Small	Less than 30 cm	Low Diversity
394	Poor	Large	Greater than 30 cm	High Diversity
395	Fair	Small	Unknown	Low Diversity
396	Poor	Medium	Less than 30 cm	High Diversity

Table C-5. (Continued)

Site No 24LN---	Site Condition	Site Size	Site Depth	Site Type
397	Poor	Large	Unknown	Low Diversity
398	Destroyed	Small	Unknown	Low Diversity
399	Poor	Medium	Unknown	Low Diversity
400	Poor	Large	Unknown	Low Diversity
401	Poor	Medium	Unknown	Historic Debris
402	Destroyed	Medium	Unknown	Low Diversity
403	Poor	Small	Unknown	Historic Structure
404	Poor	Medium	Unknown	Low Diversity
405	Fair	Small	Unknown	Low Diversity
406	Fair	Small	Unknown	Low Diversity
407	Fair	Small	Unknown	Low Diversity
408	Good	Small	Unknown	Low Diversity
409	Poor	Small	Unknown	Historic Structure
410	Good	Large	Unknown	Low Diversity
411	Poor	Small	Unknown	Low Diversity
412	Fair	Medium	Unknown	Low Diversity
413	Fair	Small	Unknown	Low Diversity
414	Fair	Small	Unknown	FCR Only
415	Fair	Medium	Unknown	Low Diversity
416	Fair	Medium	Unknown	Low Diversity
417	Good	Large	Greater than 30 cm	High Diversity
418	Destroyed	Medium	Unknown	Low Diversity
419	Poor	Small	Unknown	Low Diversity
420	Fair	Medium	Unknown	Low Diversity
421	Fair	Medium	Unknown	Low Diversity
422	Poor	Small	Unknown	Low Diversity
423	Good	Medium	Less than 30 cm	High Diversity
424	Poor	Small	Less than 30 cm	Low Diversity
425	Poor	Small	Unknown	Low Diversity
426	Fair	Medium	Unknown	Low Diversity
427	Fair	Large	Less than 30 cm	Low Diversity
428	Poor	Small	Unknown	FCR Only
429	Poor	Medium	Less than 30 cm	Low Diversity
430	Poor	Small	Unknown	Low Diversity
431	Fair	Small	Unknown	FCR Only
432	Fair	Medium	Unknown	Low Diversity
433	Poor	Medium	Unknown	FCR and Bone
434	Poor	Small	Unknown	Low Diversity
435	Fair	Small	Unknown	Low Diversity
436	Fair	Small	Unknown	Debitage Only
437	Poor	Small	Unknown	Low Diversity
[illegible]	Poor	Small	Unknown	FCR Only
[illegible]	Poor	Medium	Unknown	Low Diversity

Table C-5. (Continued)

Site No 24LN---	Site Condition	Site Size	Site Depth	Site Type
440	Destroyed	Small	Unknown	Low Diversity
441	Fair	Medium	Unknown	Low Diversity
442	Poor	Small	Unknown	Debitage Only
443	Good	Large	Greater than 30 cm	High Diversity
444	Poor	Large	Unknown	Historic Structure
445	Poor	Large	Unknown	Historic Structure
446	Fair	Medium	Less than 30 cm	Low Diversity
447	Poor	Small	Unknown	Low Diversity
448	Fair	Small	Unknown	FCR and Bone
449	Fair	Small	Unknown	Low Diversity
451	Poor	Small	Unknown	Historic Structure
452	Fair	Small	Unknown	Low Diversity
487	Poor	Medium	Unknown	Low Diversity
488	Poor	Small	Unknown	Low Diversity
501	Unknown	Small	Unknown	High Diversity
502	Unknown	Medium	Greater than 30 cm	High Diversity
503	Unknown	Large	Less than 30 cm	High Diversity
504	Unknown	Large	Greater than 30 cm	Missing Data
505	Unknown	Unknown	Unknown	Low Diversity
506	Unknown	Small	Greater than 30 cm	Low Diversity
507	Unknown	Unknown	Unknown	FCR and Bone
508	Unknown	Medium	Unknown	Low Diversity
509	Unknown	Unknown	Less than 30 cm	High Diversity
510	Good	Small	Less than 30 cm	Rock Art
512	Unknown	Unknown	Unknown	Low Diversity
513	Unknown	Medium	Less than 30 cm	High Diversity
514	Unknown	Unknown	Unknown	Low Diversity
515	Unknown	Medium	Less than 30 cm	Missing Data
516	Unknown	Medium	Unknown	Low Diversity
517	Unknown	Large	Greater than 30 cm	High Diversity
518	Unknown	Unknown	Unknown	Low Diversity
520	Unknown	Large	Unknown	High Diversity
521	Poor	Large	Less than 30 cm	Historic Structure
522	Unknown	Large	Unknown	Low Diversity
523	Destroyed	Small	Less than 30 cm	Rock Alignment
524	Unknown	Medium	Unknown	Low Diversity
525	Unknown	Medium	Greater than 30 cm	FCR Only
530	Good	Small	Unknown	Rock Art
651	Destroyed	Small	Unknown	Low Diversity
652	Fair	Medium	Unknown	Low Diversity
653	Good	Large	Unknown	Low Diversity
654	Fair	Small	Unknown	FCR Only
655	Poor	Medium	Unknown	Historic Debris

Table C-5. (Continued)

Site No 24LN---	Site Condition	Site Size	Site Depth	Site Type
656	Good	Large	Greater than 30 cm	High Diversity
657	Fair	Large	Unknown	Historic Debris
658	Poor	Large	Unknown	FCR and Bone
659	Poor	Large	Unknown	FCR Only
660	Fair	Large	Unknown	FCR and Bone
661	Fair	Medium	Unknown	Low Diversity
662	Poor	Medium	Unknown	FCR and Bone
663	Poor	Small	Unknown	FCR and Bone
664	Poor	Medium	Unknown	FCR and Bone
665	Fair	Medium	Less than 30 cm	Low Diversity
666	Poor	Medium	Less than 30 cm	Low Diversity
667	Fair	Small	Unknown	FCR and Bone
668	Poor	Medium	Unknown	FCR and Bone
669	Fair	Medium	Unknown	Low Diversity
670	Good	Medium	Unknown	Historic Structure
671	Poor	Large	Unknown	Low Diversity
672	Fair	Medium	Unknown	FCR and Bone
673	Fair	Medium	Unknown	Low Diversity
674	Fair	Medium	Unknown	Low Diversity
675	Poor	Large	Unknown	Low Diversity
676	Fair	Medium	Unknown	Low Diversity
677	Fair	Medium	Greater than 30 cm	Low Diversity
678	Poor	Small	Unknown	FCR Only
679	Fair	Medium	Less than 30 cm	Low Diversity
680	Poor	Small	Unknown	Low Diversity
681	Fair	Small	Unknown	Low Diversity
682	Fair	Medium	Unknown	Low Diversity
683	Poor	Small	Unknown	FCR and Bone
684	Fair	Medium	Unknown	Low Diversity
685	Poor	Large	Unknown	Historic Debris
686	Poor	Small	Less than 30 cm	Low Diversity
687	Poor	Medium	Unknown	Historic Structure
688	Fair	Small	Less than 30 cm	Low Diversity
689	Fair	Small	Unknown	FCR Only
690	Fair	Large	Unknown	Low Diversity
691	Fair	Large	Less than 30 cm	Low Diversity
692	Good	Medium	Less than 30 cm	Low Diversity
693	Fair	Small	Unknown	Low Diversity
694	Good	Small	Unknown	FCR Only
695	Good	Medium	Unknown	Low Diversity
696	Poor	Large	Unknown	Low Diversity
697	Fair	Medium	Unknown	Low Diversity
698	Poor	Small	Less than 30 cm	Low Diversity

Table C-5. (Continued)

Site No 24LN---	Site Condition	Site Size	Site Depth	Site Type
699	Fair	Large	Unknown	Low Diversity
700	Poor	Medium	Less than 30 cm	FCR and Bone
701	Fair	Medium	Less than 30 cm	Historic Structure
702	Good	Small	Unknown	Debitage Only
703	Poor	Large	Unknown	Low Diversity
704	Good	Small	Greater than 30 cm	Low Diversity
705	Fair	Medium	Unknown	Historic Structure
706	Fair	Large	Less than 30 cm	High Diversity
707	Good	Medium	Greater than 30 cm	Low Diversity
708	Fair	Medium	Less than 30 cm	Low Diversity
709	Fair	Medium	Less than 30 cm	Low Diversity
710	Poor	Medium	Unknown	Low Diversity
711	Poor	Medium	Less than 30 cm	High Diversity
712	Fair	Medium	Less than 30 cm	Low Diversity
713	Good	Large	Unknown	Low Diversity
714	Fair	Small	Unknown	Historic Debris
715	Poor	Large	Less than 30 cm	Low Diversity
716	Good	Small	Unknown	FCR and Bone
1052	Unknown	Unknown	Unknown	Missing Data
1053	Unknown	Unknown	Unknown	Missing Data
1054	Fair	Large	Greater than 30 cm	High Diversity
1055	Good	Medium	Unknown	High Diversity
1056	Good	Medium	Less than 30 cm	High Diversity
1057	Fair	Medium	Unknown	Low Diversity
1058	Good	Large	Greater than 30 cm	High Diversity
1059	Fair	Medium	Unknown	High Diversity
1060	Poor	Large	Unknown	High Diversity
1061	Poor	Small	Unknown	Low Diversity
1062	Poor	Small	Unknown	Missing Data
1063	Unknown	Unknown	Unknown	Missing Data
1064	Poor	Small	Unknown	Missing Data
1065	Unknown	Unknown	Unknown	Missing Data
1066	Destroyed	Small	Unknown	Low Diversity
1067	Unknown	Unknown	Unknown	Missing Data
1068	Unknown	Unknown	Unknown	Missing Data
1069	Unknown	Unknown	Unknown	Missing Data
1070	Good	Large	Unknown	Low Diversity
1072	Fair	Small	Unknown	Low Diversity
1073	Fair	Large	Greater than 30 cm	High Diversity
1074	Poor	Large	Unknown	High Diversity
1075	Poor	Large	Unknown	Low Diversity
1076	Poor	Small	Unknown	High Diversity
1077	Poor	Small	Unknown	FCR Only

Table C-5. (Continued)

Site No 24LN---	Site Condition	Site Size	Site Depth	Site Type
1078	Poor	Medium	Unknown	Low Diversity
1079	Poor	Small	Unknown	Low Diversity
1080	Destroyed	Small	Unknown	Low Diversity
1081	Destroyed	Small	Unknown	Low Diversity
1082	Destroyed	Small	Unknown	Historic Structure
1083	Destroyed	Small	Unknown	Debitage Only
1084	Destroyed	Small	Unknown	Low Diversity
1085	Destroyed	Small	Unknown	Low Diversity
1086	Destroyed	Large	Unknown	Low Diversity
1087	Poor	Medium	Unknown	Low Diversity
1089	Fair	Small	Unknown	Historic Structure
1090	Fair	Medium	Unknown	Historic Structure
1091	Fair	Small	Unknown	FCR Only
1092	Poor	Medium	Unknown	Low Diversity
1093	Fair	Small	Unknown	Low Diversity
1094	Fair	Medium	Unknown	Low Diversity
1095	Poor	Small	Unknown	Low Diversity
1096	Poor	Large	Unknown	Low Diversity
1097	Fair	Large	Less than 30 cm	Low Diversity
1098	Poor	Small	Unknown	Low Diversity
1099	Fair	Small	Unknown	Rock Alignment
1100	Fair	Large	Unknown	Historic Structure
1101	Good	Small	Unknown	Rock Alignment
1102	Fair	Small	Unknown	Historic Structure
1103	Fair	Medium	Unknown	Historic Structure
1142	Poor	Unknown	Unknown	Historic Debris
1143	Unknown	Unknown	Unknown	Missing Data
1144	Poor	Large	Greater than 30 cm	Low Diversity
1146	Poor	Small	Unknown	Low Diversity
1147	Unknown	Unknown	Unknown	Missing Data
1148	Unknown	Unknown	Unknown	Missing Data
1149	Unknown	Unknown	Unknown	Missing Data
1150	Unknown	Unknown	Unknown	Missing Data

APPENDIX D

LITHIC ARTIFACTS

by
Alston V. Thoms and Deborah L. Olson

This appendix provides definitions, descriptions, and metric data for the flaked and nonflaked lithics. Information presented here represents the data base for the morphological/technological analysis. Rough drafts of some tool and debitage descriptions presented here were written by Miranda Warburton as part of the preliminary lithic analysis she conducted for this project. Subsequently, and in the light of new information the drafts were augmented, rewritten, and reformatted. Draft authorship is indicated parenthetically, otherwise sections are written by the authors of the appendix.

Flaked Lithic Byproducts (Miranda Warburton)

Cobble Cores (Figure 8-2, a-d)

These are cores which have cortex on at least two faces, they are generally biconvex in cross section. Thirty-four artifacts fall into this class. These are further subdivided into two subclasses unidirectional and multidirectional (Table D-1).

The unidirectional subclass is defined by flake scars originating from the same point or that are oriented in the same direction. These eight cores are similar to those in the LAURD collection that are termed single platform cores and initially struck cores (Roll and Smith 1982). Material types include various mudstones and quartzite.

The multidirectional subclass includes 26 cores. Flake scars are intersecting and/or originate on different edges from different directions. Material types include mudstones, green, grey, and black in color, as well as quartzites. One specimen--24LN1054-298--has numerous flake scars and heavy battering along the margins. Two others, 24LN1054-177 and 24LN1054-499, have evidence of battering on the flaked margin. Another case (24LN385-117) has pronounced crushing at the point of impact indicating the application of excessive force. One specimen (24LN1054-197) has some evidence of battering along the margin and 24LN1054-212 appears slightly battered. In general, these cores have only a few flake scars, indicating that the flakes were the products as opposed to the core itself. However, several specimens appear to have been used as hammerstones or some other battering tool.

Split Cobble Cores (Figure 8-4, c-f)

These cores are from a split cobble. By definition they have cortex on at least one surface and the cross section is clearly plano-

Table D-1. Metric (mm) and Material Type Attributes for Morpho/Techno Class Cobble Cores, Subclasses: Unidirectional (N=8) and Multidirectional (N 26).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Unidirectional					
374-1	Mudstone	94.30	68.25	52.00	Thick Edge Mod.
423-60	Quartzite	125.30	72.05	34.90	Thick Edge Mod.
652-1	Mudstone	109.15	104.60	66.15	Core
656-198	Quartzite	166.00	109.90	72.00	Core
661-11	Mudstone	124.50	90.70	41.70	Thick Edge Mod.
666-20	Mudstone	189.00	72.20	52.45	Core
1057-1	Quartzite	112.00	107.00	48.50	Core
1074-25	Mudstone	80.85	55.90	35.90	Core
Multidirectional					
193-79/S/12	Mudstone	81.10	63.60	40.35	Core
365-10	Mudstone	132.30	94.75	59.85	Core
372-7	Mudstone	123.00	81.25	35.30	Thick Edge Mod.
385-117	Mudstone	66.90	55.30	41.60	Core
386-75	Mudstone	55.45	45.45	25.15	Core
386-78	Mudstone	78.45	67.30	40.80	Thick Edge Mod.
394-10	Quartzite	96.05	89.35	49.10	Core
671-4	Mudstone	62.65	40.80	18.60	Core
692-4	Mudstone	62.50	35.90	35.15	Core
704-10	Mudstone	127.05	80.65	73.95	Core
1054-177	Mudstone	96.25	80.15	54.45	Thick Edge Mod.
1054-194	Mudstone	148.90	66.10	67.40	Thick Edge Mod.
1054-197	Quartzite	90.40	69.25	60.40	Core
1054-212	Quartzite	122.75	84.40	58.70	Thick Edge Mod.
1054-298	Mudstone	83.80	78.40	61.30	Thick Edge Mod.
1054-299	Quartzite	100.00	92.30	55.75	Core
1054-304	Mudstone	57.30	43.80	21.80	Thick Edge Mod.
1054-362	Mudstone	78.75	71.50	49.45	Core
1054-399	Mudstone	54.55	18.90	32.70	Thick Edge Mod.

Table D-1. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Multidirectional					
1054-1330	Mudstone	68.70	54.60	26.65	Thick Edge Mod.
1054-1341	Mudstone	85.70	47.80	23.40	Core
1054-1352	Mudstone	78.80	65.50	30.00	Core
1054-1356	Mudstone	56.40	44.00	33.45	Core
1054-1449	Mudstone	64.55	47.45	30.40	Core
1073-277	Mudstone	59.10	40.00	25.10	Core
1074-79/S/1	Mudstone	76.90	67.10	30.05	Core

convex; the ventral surfaces do not exhibit a bulb of force. There are 25 split cobble cores and two subclasses of split cobble cores, unidirectional and multidirectional (Table D-2).

Most (20) of the unidirectional split cobble cores (N=22) are moderate size, grey to green mudstone cobbles and two are large sized mudstone cobbles. Flake scars are oriented in the same direction. The cobbles do not appear to have been split intentionally, rather, it seems as though the knappers tried to take advantage of natural platforms along the flat face. The raw material of these cobbles does not lend itself to being flaked easily. All of these cores, have fewer than seven flake scars.

The second subclass--multidirectional split cobble cores--includes three medium (ca. 10 cm in diameter) to small (ca. 5 cm in diameter) size cobbles. All are made from mudstone and have six or fewer flakes scars.

Overall, split cobble cores appear to be flaked minimally and relatively unsuccessfully. It is suggested that artifacts in this class are almost all byproducts of flake production. There is little evidence to suggest that these cores were used for other purposes.

Partial Cobble Cores (Figure 8-2, e-f; Figure 8-3, a-b)

These partial cores (N=75) retain at least some cortex on one or more edges or faces (Table D-3). They probably represent cores flaked more extensively than either the cobble or split cobble cores, but not as extensively as the decorticated cores. The class is further subdivided into unidirectional and multidirectional cores.

The unidirectional partial cobble core subclass contains two specimens. Flake scars are oriented in the same direction. These cores tend to have more flake scars than do the other classes of cobble cores but,they too, appear to have been discarded early in the reduction process.

There are 73 cores in the multidirectional subclass. Most are made from various mudstones and several are quartzite. Of the quartzite cores, only one (24LN1054-198) appears to have been flaked systematically. Most others range in size from small to large, but they are flaked haphazardly and discarded early in the reduction process as evidenced by fewer than seven flake scars. One of the black mudstone artifacts (24LN1054-422) may have been heat treated as evidenced from visual inspection indicating increased luster and finer texture on several flake scars. The finer grain mudstone artifacts are small to medium in size with one exception (24LN1054-301) which is large and exhibits approximately 10 flake scars. Specimen (24LN1054-1244) is a small core which appears to represent an attempt to manufacture a biface, but it was discarded before completion. The black coarser grain mudstone artifacts range in size from medium to small. In the cases where the raw material is not flawed these cores are reduced further

Table D-2. Metric (mm) and Material Type Attributes for Morpho Techno Class Split Cobble Cores, Subclasses: Unidirectional (N=22) and Multidirectional (N=3).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho Functional Type
Unidirectional					
366-22	Quartzite	151.50	142.30	70.75	Thick Edge Mod.
385-116	Mudstone	92.70	56.20	23.10	Core
387-16	Mudstone	51.55	29.75	15.45	Core
388-34	Mudstone	103.30	73.60	29.55	Thick Edge Mod.
388-48	Mudstone	57.45	45.20	22.20	Core
388-52	Mudstone	87.85	48.70	33.75	Thick Edge Mod.
1054-128	Mudstone	78.10	69.25	30.25	Thick Edge Mod.
1054-1249	Mudstone	79.60	64.80	28.80	Thick Edge Mod.
1054-1254	Mudstone	104.65	98.05	53.10	Thick Edge Mod.
1054-1332	Mudstone	65.10	48.50	32.70	Thick Edge Mod.
1054-1411	Mudstone	70.00	60.00	29.00	Thick Edge Mod.
1054-1437	Mudstone	108.80	71.60	26.30	Core
1055-11	Mudstone	107.05	81.40	38.30	Core
1055-22	Mudstone	74.30	71.80	28.25	Thick Edge Mod.
1058-253	Mudstone	85.20	66.65	27.90	Thick Edge Mod.
1058-272	Mudstone	69.75	64.20	26.00	Core
1058-287	Mudstone	62.75	61.55	32.65	Thick Edge Mod.
1058-288	Mudstone	75.35	56.75	37.50	Thick Edge Mod.
1060-46	Mudstone	137.20	97.25	55.00	Thick Edge Mod.
1073-24	Mudstone	108.35	72.65	41.90	Core
1073-256	Quartzite	64.55	47.65	33.50	Core
1073-274	Mudstone	61.60	45.45	21.30	Core
Multidirectional					
1055-20	Mudstone	73.70	55.80	40.30	Thick Edge Mod.
1055-23	Mudstone	99.40	45.70	26.55	Thick Edge Mod.
1055-26	Mudstone	89.10	47.20	17.35	Core

Table D-3. Metric (mm) and Material Type Attributes for Morpho/Techno Class Partial Cobble Cores, Subclasses: Unidirectional (N=2) and Multidirectional (N=73).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Unidirectional					
1057-14	Quartzite	140.00	108.50	75.90	Core
IA-42	Quartzite	99.45	81.25	36.70	Core
Multidirectional					
189-1	Mudstone	78.80	53.85	23.50	Core
364-28	Mudstone	48.75	41.05	22.75	Core
365-20	Quartzite	75.60	61.80	46.35	Core
365-21	Mudstone	73.85	55.80	27.80	Core
382-3	Mudstone	53.50	43.55	23.35	Core
387-6	Mudstone	68.70	43.40	46.15	Thick Edge Mod.
387-32	Quartzite	101.30	88.10	38.10	Core
387-33	Mudstone	97.85	75.60	29.25	Thick Edge Mod.
388-24	Quartzite	110.35	58.65	47.10	Thick Edge Mod.
388-25	Quartzite	87.10	60.05	60.05	Core
388-28	Mudstone	68.70	68.25	29.40	Core
388-31	Mudstone	59.90	56.45	21.75	Core
388-40	Mudstone	116.35	69.70	49.30	Core
388-45	Mudstone	64.00	45.70	21.65	Core
388-50	Quartzite	90.40	74.00	36.80	Core
388-199	Mudstone	39.95	38.05	12.50	Core
692-5	Mudstone	68.85	66.95	26.45	Core
1051-3	Mudstone	60.00	49.40	33.55	Core
1054-95	Mudstone	51.80	25.05	15.90	Core
1054-156	Mudstone	112.35	65.30	24.40	Core
1054-192	Mudstone	136.20	57.75	33.20	Core
1054-198	Quartzite	91.05	78.30	69.90	Thick Edge Mod.
1054-210	Mudstone	81.40	65.55	43.20	Core
1054-214	Mudstone	79.60	67.50	37.50	Thick Edge Mod.
1054-250	Mudstone	45.40	37.85	18.65	Core
1054-301	Mudstone	105.00	95.70	68.90	Thick Edge Mod.
1054-327	Mudstone	62.75	44.60	35.70	Core

Table D-3. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Multidirectional					
1054-329	Mudstone	68.25	38.80	19.35	Core
1054-335	Mudstone	49.25	37.25	21.10	Core
1054-337	Mudstone	67.05	53.90	27.45	Core
1054-405	Mudstone	89.75	78.55	21.85	Thick Edge Mod.
1054-450	Mudstone	63.05	44.55	26.40	Core
1054-453	Mudstone	48.05	26.80	16.15	Core
1054-463	Quartzite	141.55	101.50	71.85	Core
1054-464	Mudstone	71.10	51.10	30.45	Core
1054-472	Mudstone	78.05	67.15	43.40	Thick Edge Mod.
1054-1244	Mudstone	45.35	41.20	19.55	Core
1054-1248	Mudstone	77.40	57.90	24.35	Thick Edge Mod.
1054-1250	Mudstone	67.85	52.90	39.30	Core
1054-1322	Mudstone	35.40	29.05	13.90	Core
1054-1333	Mudstone	54.70	49.25	26.20	Thick Edge Mod.
1054-1335	Mudstone	64.40	42.05	32.25	Core
1054-1336	Mudstone	70.75	55.70	30.55	Core
1054-1338	Mudstone	41.05	39.65	17.65	Core
1054-1344	Quartzite	99.60	55.20	35.80	Core
1054-1345	Mudstone	85.80	62.75	44.70	Core
1054-1346	Quartzite	70.80	61.20	48.65	Thick Edge Mod.
1054-1347	Quartzite	70.80	57.00	48.85	Thick Edge Mod.
1054-1348	Mudstone	70.15	55.05	21.65	Core
1054-1349	Quartzite	130.85	103.70	64.25	Core
1054-1351	Mudstone	80.20	63.45	42.90	Core
1054-1355	Mudstone	75.65	70.60	46.65	Core
1054-1397	Mudstone	71.30	69.10	35.40	Thick Edge Mod.
1054-1398	Mudstone	73.75	64.60	22.70	Thick Edge Mod.
1058-286	Mudstone	41.40	34.10	17.40	Core
1059-39	Mudstone	69.65	54.55	33.70	Core
1059-45	Mudstone	62.50	54.25	26.70	Core
1060-23	Mudstone	62.05	37.10	24.00	Core
1060-24	Mudstone	69.30	60.00	34.90	Core
1060-26	Mudstone	65.80	49.40	27.75	Core
1073-26	Quartzite	97.55	72.80	47.15	Core
1073-27	Quartzite	91.85	57.80	32.30	Core
1073-45	Mudstone	73.20	61.90	32.00	Core
1073-257	Quartzite	85.75	35.45	23.65	Core
1073-258	Mudstone	64.00	35.40	22.05	Core
1073-264	Mudstone	63.55	34.30	23.04	Core
1073-268	Mudstone	47.50	29.10	22.90	Core
1073-270	Quartzite	64.25	44.30	15.65	Core
1073-276	Mudstone	60.55	38.15	24.40	Core
1073-278	Mudstone	82.40	70.00	43.50	Core
1080-2	Mudstone	108.15	81.50	41.25	Core
1080-3	Mudstone	61.40	54.10	19.75	Core
IA-38	Mudstone	69.05	68.90	37.00	Core

than either the quartzite or very fine grain mudstone ones. This is evidenced by the more numerous and smaller flake scars (average ca. 10 scars/core). Only one (24LN1054-214) shows signs of battering.

Overall, the partial cobble cores seem to represent a fortuitous use of the available raw material for the production of flakes either to be used as sharp cutting edges or subjected to further reduction to form tools.

<u>Decorticated Cores</u> (Figure 8-3, f-g; Figure 8-4, a-b)

This class of cores (N=41) is defined by the absence of the cortex on any surface. They have been reduced more than those in the cobble classes and as a result tend to be smaller. Decorticated cores tend to be made from finer grain raw materials in comparison to the cobble cores. Decorticated cores are divided into two subclasses, unidirectional and multidirectional.

Most of the nine cores (Table D-4)in the unidirectional subclass are made on large flakes. Flake scars originate along one margin and from one direction. The mudstone cores are flaked more extensively than are the quartzite examples.

The majority of the 32 multidirectional decorticated cores are made from mudstone, but quartzite is well represented (Table D-4). Quartzitic cores tend to be larger and minimally flaked. All the other cores are small to medium in size and are reduced more than the quartzite specimens.

<u>Bipolar Cores</u> (Figure 8-3, c-e)

These cores are difficult to define because the technique of manufacture is understood poorly. Attributes considered as diagnostic are: (1) crushing on at least two opposing ends of the core, each of which has a pronounced bulb of force; and (2) relatively parallel margins of the flake scars. Based on these attributes 10 cores are classed as bipolar. All of the bipolar cores have some cortex. They range in size from 2.4 to 5.5 cm in maximum dimension (Table D-5).

Two of these (24LN391-2, 24LN391-1) fit together to form the only chert core in the collection. Seven of the cores are black to grey mudstone (one with inclusions) and two are white quartzite. Due to the nature of the raw material the attributes on the quartzite cores (24LN1054-1399 and 24LN365-26) are difficult to discern. Crushing on opposing ends is quite obvious, but the flake scars are fairly obscure. The coarser grain black mudstone cores have only a few flake scars. On the other hand, one of the finer grain mudstone cores (24LN1054-447) has numerous flake scars and numerous crushed areas, it seems to be the most successfully (i.e., the highest number of flakes detached) reduced core.

Table D-4. Metric (mm) and Material Type Attributes for Morpho/Techno Class Decorticated Cores, Subclasses: Unidirectional (N=9) and Multidirectional (N=32).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Unidirectional					
193-79/S/1	Mudstone	60.75	37.85	10.80	Core
193-79/S/18	Mudstone	61.35	50.35	33.50	Core
387-35	Quartzite	150.65	123.20	79.55	Core
410-1	Quartzite	177.00	147.80	39.90	Thick Edge Mod.
418-1	Mudstone	68.10	48.00	38.30	Thick Edge Mod.
1054-189	Quartzite	109.25	96.20	36.10	Thick Edge Mod.
1054-1323	Mudstone	68.90	66.90	51.70	Thick Edge Mod.
1059-33	Quartzite	50.85	42.00	24.90	Core
1073-79/S/36	Quartzite	74.60	46.75	26.40	Thick Edge Mod.
Multidirectional					
364-17	Other	89.75	60.85	37.15	Core
364-32	Mudstone	55.35	41.55	41.35	Core
385-122	Mudstone	40.80	31.90	18.10	Core
386-80	Mudstone	60.20	59.10	37.00	Core
387-14	Quartzite	44.70	39.75	13.45	Core
388-44	Mudstone	57.55	45.00	19.50	Core
388-53	Quartzite	76.90	51.35	20.85	Core
388-58	Mudstone	106.00	93.80	56.70	Core
423-63	Quartzite	66.25	59.75	31.40	Core
656-186	Mudstone	59.30	37.10	24.70	Core
1054-165	Mudstone	61.00	32.15	24.40	Core
1054-190	Quartzite	87.75	75.00	36.80	Thick Edge Mod.
1054-336	Mudstone	48.75	27.00	21.30	Core
1054-341	Mudstone	50.65	33.10	18.20	Core
1054-460	Quartzite	142.85	113.85	33.40	Core
1054-524	Mudstone	42.35	29.55	17.40	Core
1054-1324	Quartzite	57.60	28.50	21.55	Core
1054-1328	Mudstone	66.90	55.20	35.30	Thick Edge Mod.

Table D-4. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Multidirectional					
1054-1337	Mudstone	38.25	35.10	19.20	Core
1054-1342	Mudstone	57.80	37.10	27.00	Core
1054-1440	Mudstone	42.50	34.85	29.70	Thick Edge Mod.
1057-5	Mudstone	52.20	27.25	19.35	Core
1057-12	Mudstone	48.20	32.50	14.10	Core
1058-267	Mudstone	59.05	46.85	18.25	Core
1058-269	Mudstone	46.40	39.90	25.35	Core
1059-44	Quartzite	98.40	66.75	35.65	Core
1060-43	Mudstone	56.05	42.40	19.45	Core
1073-241	Quartzite	38.75	31.85	27.35	Core
1073-260	Mudstone	47.60	33.30	24.90	Core
1073-262	Mudstone	65.80	33.80	31.50	Core
1073-269	Mudstone	61.50	56.10	19.70	Core
1074-37	Mudstone	41.20	38.85	19.55	Core

Table D-5. Metric (mm) and Material Type Attributes for Morpho/ Techno Class Bipolar Cores (N=10).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
365-26	Quartzite	36.75	33.20	18.80	Core
385-121	Mudstone	30.90	22.00	18.30	Core
388-161	Mudstone	46.15	35.20	20.20	Core
391-1	Chert	26.10	24.40	18.15	Core
(-2[fits w/#1])	(Chert)	(24.35)	(23.90)	(14.50)	(Core)
691-2	Mudstone	55.20	45.80	10.75	Core
1054-447	Mudstone	33.55	30.95	29.35	Core
1054-1329	Mudstone	53.45	41.20	14.50	Thick Edge Mod.
1054-1399	Quartzite	38.00	30.40	10.05	Core
1058-285	Mudstone	45.40	41.80	14.50	Core
1073-266	Mudstone	48.15	40.30	19.35	Core

Bipolar cores are fewer in number than other kinds of cores and although they are not well understood, their presence is noteworthy. It is possible that some of the battered stone artifacts that exhibit a small depression on one or more faces may have been used as anvil stones in conjunction with bipolar reduction. Interesting, about one-half of the sites with bipolar cores also yielded battered stone artifacts with small circular depressions on one or two faces.

Flaked Lithic Products: Nonhaft Bifaces (Miranda Warburton)

This subcategory of artifacts includes all items that are flaked invasively on two faces and do not exhibit obvious hafting modifications such as notches or stems. These are distinguished from cores because all the flakes originate along the margin and are generally oriented toward the opposite margin. The diagnostic characteristic of bifaces is that they are flaked systematically from the margins, rather than an unsystematic use of any available platform, as is the case for cores.

Biface I

This class (N=29) is made up of bifaces with sinuous margins. Relatively large flakes have been removed. Most Biface Is have a thickness of at least 4.0 cm. These artifacts probably are viewed best as bifacial cores. They are further subdivided into two subclasses, partial and complete (Table D-6). Specimens in the Biface I class are roughly equivalent to opposite face cores in the LAURD collection. Some Biface I specimens are probably typologically the same as the biface preform category of the LAURD collection (Roll and Smith 1982).

Complete (N=22)

These bifaces (Figure 8-5, c-d) are fairly chunky, but have all of their margin flaked. Five are large and are made from quartzite; they retain some cortex. Of these, 24LN365-19 has indentations on both margins which may be notches; it may have been hafted or have served as a net weight. Ten of the bifaces are medium size and seven are quartzite. All of the medium sized bifaces have about 10 or more flake scars. There are seven small bifaces, and all have seven or more flake scars.

Partial (N=7)

Artifacts in this subclass (Figure 8-5, a-b) are defined as having less than 50 percent of their margins flaked and having cortex on both faces. They tend to be made from river cobbles. Of the seven artifacts, three are quartzite. One of these (24LN388-22) is very large (ca. greater than 20 cm in maximum dimension) with 51-75 percent cortex overall and only a few flakes removed from both faces. Another quartzite artifact (24LN1074-9) is smaller, with 51-75 percent cortex

Shoulders: sloping
Haft element points of juncture: lateral-lateral to lateral-coincidental
Notch characteristic: as wide as deep
Basal edge characteristic: concave
Flaking: Primary flake scars are obscured by expanding, conchoidal and lamellar secondary flake scars that are more extensive on one face than the other.
Grinding: not evident
Type of blank: probably flake
Similar to: Avonlea
Time period: Late Prehistoric Period

Subtype c (N=2), Figure 8-10, e-f
Blade shape: excurvate
Cross section: plano-convex
Shoulder: distinct to sloping
Haft element points of juncture: lateral-coincidental
Notch characteristic: as wide as deep
Basal edge characteristic: convex
Flaking: Primary flake scars are limited to one face. Expanding to lamellar secondary flake scars are invasive on one face and marginal on the other.
Grinding: not evident
Similar to: Old Womans Side-Notched
Time period: Late Prehistoric Period

Subtype Fragments (N=3)
Cross section: plano-convex
Notch characteristic: wide, shallow side-notch (1); narrow and deep (1); undetermined (1)
Basal edge characteristic: concave (1); straight (1); missing (1)
Type of blank: probably flakes
Time period: Late Prehistoric Period

Small, Corner-Notched, Concave Base Projectile Points (Figure 8-10, l-p)

Summary Outline (N=13)
Blade shape: triangular (10); excurvate (3)
Cross section: plano-convex (7); biconvex (6)
Shoulders: distinct to well rounded
Haft element points of juncture: lateral-basal
Haft element characteristic: lateral edges are expanding
Notch characteristic: very wide and relatively shallow
Basal edge characteristic: markedly concave to almost straight
Flaking: Primary flake scars are present on at least one face. Expanding and conchoidal secondary flake scars are extensive and uniform; they tend to cover most of one face and are marginal on the other face.

Table D-14. Metric (mm) and Material Type Attributes for Small, Side-Notched Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Sub-Class
191-79/S/1	Blk,Tns,Cht	27.2	15.4	3.3	15.4	15.1	9.0	2.9	20.9	6.8	a
398-1	Blk,Tns,Cht	--	--	--	--	14.5	8.9	--	--	--	a
417-2	Gry,Opq,Mud	--	16.1	3.2	14.4	16.1	9.3	2.1	--	8.2	a
699-1	Blk,Opq,Mud	18.3	11.1	3.2	11.1	12.7	7.1	2.2	12.2	7.1	a
711-1	Red,Tns,Cht	-25.5	12.2	3.3	12.1	12.2	[illegible]	3.2	-19.9	6.1	a
1074-17	Blk,Tns,Cht	34.9	13.8	4.4	13.8	13.8	8.2	1.6	27.7	8.0	a
Sub-total (6)											
Mean		26.48	13.72	3.48	13.4	14.07	8.45	2.4	20.18	7.24	
Std Dev.		6.81	2.10	0.52	1.74	1.47	0.80	0.64	6.35	0.97	
1058-14	Bwn,Tns,Cht	27.2	15.5	3.3	15.5	14.4	12.2	4.3	22.2	7.1	b
417-1	Red,Opq,Cht	18.8	12.0	2.1	10.7	12.0	7.9	2.8	13.3	5.5	c
1054-62	Red,Tns,Cht	18.3	8.3	2.5	8.2	8.3	5.0	3.1	12.9	5.4	c
Sub-total (2)											
Mean		18.55	10.15	2.3	9.45	10.15	6.45	2.95	13.1	5.45	
Std Dev		0.35	2.62	0.28	1.77	2.62	2.05	0.21	0.28	0.07	
417-69	Bwn,Opq,Cht	--	--	2.4	12.1	--	9.1	--	--	--	Frag.
688-1	Gry,Tns,Cht	--	14.4	3.3	14.4	--	9.1	1.3	19.7	--	Frag.
1054-31	Bwn,Opq,Cht	--	--	3.6	--	--	--	--	--	--	Frag.
Sub-total (3)											
Mean				3.1	13.25		9.1				
Std Dev				0.62	1.63		--				
Totals (12)											
Mean		24.31	13.2	3.14	12.77	13.23	8.59	2.61	18.6	6.78	
Std Dev		6.23	2.53	0.63	2.35	2.30	1.66	0.92	5.42	1.05	

Table D-15. Metric (mm) and Material Type Attributes for Small, Corner-Notched, Concave Base Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Class/Sub-Class
365-3	Bwn,Opq,Mud	26.0	16.2	4.4	16.2	-10.5	9.0	6.1	19.2	6.8	-
399-6	Gry,Opq,Cht	--	--	3.9	-17.0	12.5	9.3	5.5	--	7.3	-
443-3	Gry,Opq,Mud	--	13.8	4.5	13.8	-11.7	10.0	8.2	--	9.3	-
1054-34	Blk,Opq,Mud	--	-18.0	4.7	-18.0	11.4	9.0	7.7	--	8.4	-
1054-155	Red,Opq,Qtz	30.5	12.8	5.4	12.8	-9.5	8.4	9.4	20.7	9.8	-
1072-1	Bwn,Opq,Mud	24.3	16.2	4.7	16.2	11.7	9.3	6.3	15.6	9.7	-
1073-9	Blk,Opq,Mud	-37.0	15.4	5.0	15.0	11.1	9.2	6.1	-29.6	7.4	-
1073-35	Blk,Opq,Mud	17.2	13.8	4.4	13.8	-12.5	9.7	5.5	8.8	8.4	-
1073-I 79/S/42	Bwn,Opq,Mud	58.8	18.2	6.1	18.2	-10.0	7.9	8.6	50.6	9.2	-
1075-1	Bwn,Opq,Mud	-32.0	15.3	4.3	15.3	11.4	8.8	6.3	-24.1	7.9	-
Sub-total (10)											
Mean		32.3	15.5	4.7	15.6	11.2	9.1	7.0			
Std Dev		13.3	1.9	0.6	1.8	1.0	0.6	1.4			
1054-70	Blk,Opq,Mud	--	--	--	--	9.7	7.4	--	--	--	Frag.
1054-76	Gry,Opq,Cht	--	--	--	--	14.3	9.9	--	--	--	Frag.
1073-4	Blk,Opq,Mud	--	--	--	--	10.9	10.0	--	--	--	Frag.
Sub-total (3)											
Mean						11.6	9.1				
Std Dev						2.4	1.5				
Total (13)											
Mean		32.3	15.5	4.7	15.6	11.3	9.1	7.0	24.1	8.2	
Std Dev		13.3	1.9	0.6	1.8	1.3	0.8	1.4	13.4	0.9	

Flaked Lithic Products: Haft Bifaces (Projectile Points)

The term projectile point is used in a descriptive sense to refer a category of thin, symmetrical, and generally bifacially flaked stone tools with obvious hafting modifications in the form of notches, stems, or basal element grinding (Thoms 1977:222). Descriptive terminology follows that of Binford (1963) and Corliss (1972). The approach in describing and classifying specimens is to rely primarily on morphological attributes and secondarily on technological attributes. An effort is made to equate classes of projectile points with previously defined types from the region. Names of projectile point types listed in the "similar to:" category are those used by Kehoe (1966), Reeves (1970, 1973, 1974), and Flint (1982). In Chapter 8, comparisons were made with projectile points recovered during the LAURD project (Roll and Smith 1982). Comparative statements as well as suggested temporal affiliations are tentative because of the absence of absolute chronological controls.

Subclasses are described in terms of their morphological and technological attributes in outline format. The subclasses considered to be most recent in age are discussed first. Tables presenting selected metric attributes follow the summary outlines; means and standard deviations are calculated. In addition to the subclasses considered to be projectile points, there are two classes of Haft Bifaces that are probably not projectile points, the "undetermined" and "other" bifaces.

Small, Side-Notched Projectile Points (Figure 8-10, a-f)

Summary Outline (N=12)

Comments: This subclass has been divided into three subtypes based on haft element morphology. A fourth subtype includes specimens that are too fragmentary to be included in one of the three subtypes.

Subtype a (N=6), Figure 8-10, a-c
- Blade shape: triangular
- Cross section: plano-convex to biconvex
- Shoulders: abrupt near-right angles or slight barbs
- Haft element points of juncture: lateral-lateral to lateral-coincidental
- Notch characteristic: deeper than wide, forming near right angles with the lateral edge of the base
- Basal edge characteristic: slightly convext to markedly concave
- Similar to: Plains Side-Notched
- Time Period: Late Prehistoric Period

Subtype b (N=1), Figure 8-10, d
- Blade shape: excurvate
- Cross section: plano-convex

Table D-12. Metric (mm) and Material Type Attributes for Morpho/Techno Class Biface IV, Subclasses: Triangular (N=16) and Unnotched Ovoid (N=2).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Triangular					
387-7	Mudstone	32.80	22.05	5.10	Thin Biface
388-10	Quartzite	37.75	27.35	6.00	Thin Biface
704-1	Chert	32.75	24.05	6.50	Thin Biface
1054-66	Mudstone	31.75	19.40	6.75	Thin Biface
1054-218	Mudstone	37.10	21.25	7.60	Thin Biface
1054-229	Mudstone	40.85	18.55	6.85	Thin Biface
1054-421	Mudstone	36.95	21.75	3.05	Thin Biface
1054-431	Mudstone	25.80	15.80	3.75	Thin Biface
1054-1203	Quartzite	41.65	23.60	6.30	Thin Biface
1055-8	Mudstone	37.25	23.90	7.35	Thin Biface
1060-5	Mudstone	31.30	22.20	5.60	Thin Biface
1073-79/S/3	Mudstone	39.00	17.05	6.25	Thin Biface
1073-248	Mudstone	38.40	19.60	4.80	Thin Biface
1073-249	Mudstone	34.55	22.80	5.80	Thin Biface
1073-250	Mudstone	40.65	22.05	6.10	Thin Biface
1086-10	Chert	25.60	18.50	4.95	Thin Biface
Unnotched Ovoid					
441-1	Mudstone	103.35	53.50	13.05	Thin Biface
1054-1196	Mudstone	51.80	16.25	9.75	Thin Biface

Table D-13. Metric (mm) and Material Type Attributes for Morpho/Techno Class Biface IV, Subclasses: Fragment-Ovoid/Rectangular (N=7), Fragment-Pointed End (N=9), and Fragment-Medial (N=4).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morph/ Functional Type
Ovoid/Rectangular					
188-79/S/2	Chert	33.90	20.65	6.20	Thin Biface
394-4	Mudstone	37.75	29.95	5.40	Thin Biface
443-4	Chert	24.55	20.95	4.65	Thin Biface
677-1	Mudstone	24.25	22.65	5.20	Thin Biface
1055-17	Chert	18.15	20.95	6.45	Thin Biface
1073-79/S/17	Mudstone	22.70	24.35	7.35	Thin Biface
1073-79/S/27	Mudstone	66.05	48.80	13.00	Thin Biface
Pointed End					
188-79/S/3	Mudstone	27.30	28.80	6.75	Thin Biface
392-6	Chert	28.45	10.50	3.80	Thin Biface
396-8	Chert	15.10	15.00	2.75	Thin Biface
1054-85	Mudstone	21.65	32.20	5.00	Thin Biface
1054-316	Mudstone	37.60	38.90	6.80	Thin Biface
1054-427	Quartzite	11.45	29.80	4.90	Thin Biface
1054-1195	Mudstone	37.15	30.05	10.25	Thin Biface
1073-41	Quartzite	32.85	21.95	7.45	Thin Biface
IA-37	Mudstone	45.10	34.55	8.60	Thin Biface
Medial					
1054-179	Mudstone	32.40	18.35	7.70	Thin Biface
1054-222	Other	16.80	24.70	7.40	Thin Biface
1054-246	Mudstone	33.40	39.40	9.00	Thin Biface
1054-426	Quartzite	22.10	19.20	3.90	Thin Biface

Unnotched Ovoid (N=2)

This subclass (Figure 8-8, g-h) includes only two specimens. Specimen 24LN441-1 is a large mudstone biface which has one fairly straight margin and one convex margin (Table D-12). Both margins have had pressure flakes removed, which are at most only a centimeter long. Traditionally, this kind of artifact is called a knife. The other specimen 24LN1054-1196 is a small mudstone biface and traditionally, it is called a perforator.

Triangular (N=16)

Artifacts like the triangular Biface IV specimens (Figure 8-9, c-k) often are referred to as "triangular projectile points" or as arrow or dart point "preforms." Most of the specimens in this class are within arrow point or small dart point size ranges (Table D-12). Various mudstone, two chert, and two quartzite examples comprise the raw material types in this subclass. Most of the specimens appear to be made on flakes, but several may have been manufactured by reducing larger bifaces. These specimens are virtually identical to those in the LAURD collection termed unnotched bifaces, Group A or small triangular points (Roll and Smith 1982).

Fragments (N=20)

Fragments of Biface IVs (Figure 8-8, j; Figure 8-9, a-b), too imcomplete to be placed in another subclass, are subdivided on the basis of shape (Table D-13). The fragment subclass is most like the Unnotched Biface, Group F (nondiagnostic fragments) type in the LAURD collection, but probably also includes specimens that could be considered as fragments from several of the unnotched biface groups (Roll and Smith 1982).

Seven of the fragments represent ovoid ends of Biface IVs. One large, black mudstone fragment (24LN1073-79/S/27) is very similar to the large specimen in the unnotched ovoid class. The majority of the ovoid end fragments are made from mudstone. However, one is quartzite and two are black to grey translucent chert (i.e., "Top-of-the-World"). All are finely flaked, small in size and decorticated.

Nine of the fragments are classed as pointed end fragments. These artifacts appear to be the tips of medium sized bifaces that are larger than the specimens included in the projectile point category. Pointed end fragments are made from either mudstone or quartzite. A single small fragment (24LN396-8) is made of "Top-of-the-World" chert.

The final subclass includes four medial fragments. One is made from a green mudstone (i.e., argilite), another from the white opaque fossiliferous chert and a third from quartzite.

Table D-11. Metric (mm) and Material Type Attributes for Morpho/Techno Class Biface III, Subclasses: Fragment-Pointed End (N=26), Fragment-Medial (N=8), and Fragment-Undetermined (N=24).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Pointed End					
364-7	Mudstone	7.05	14.30	2.90	Thin Biface
385-6	Mudstone	23.15	16.80	6.30	Thin Biface
385-127	Quartzite	22.15	32.30	8.00	Thin Biface
386-4	Mudstone	11.30	28.05	6.10	Thin Biface
386-6	Quartzite	28.10	32.75	9.20	Thin Biface
1054-4	Quartzite	12.70	20.40	4.35	Thin Biface
1054-18	Mudstone	9.45	15.00	3.30	Thin Biface
1054-52	Mudstone	55.35	51.55	13.75	Thin Biface
1054-55	Mudstone	27.55	35.25	10.25	Thin Biface
1054-80	Quartzite	9.90	20.75	5.55	Thin Biface
1054-314	Mudstone	35.80	35.95	8.55	Thin Biface
1054-318	Quartzite	51.80	48.45	11.05	Thin Biface
1054-319	Quartzite	41.85	35.20	9.30	Thin Biface
1054-321	Mudstone	44.60	34.15	12.35	Thin Biface
1054-407	Mudstone	35.20	41.40	10.80	Thin Biface
1054-1210	Quartzite	12.55	18.70	2.50	Thin Biface
1054-1264	Quartzite	31.90	40.80	8.00	Thin Biface
1054-1443	Mudstone	4.80	6.20	1.70	Thin Biface
1054-1444	Mudstone	8.40	8.90	1.80	Thin Biface
1055-15	Mudstone	35.75	44.40	12.05	Thin Biface
1060-15	Mudstone	36.95	47.00	10.60	Thin Biface
1060-35	Quartzite	37.00	29.95	8.00	Thin Biface
1073-79/S/11	Mudstone	63.00	31.25	7.70	Thin Biface
1073-11	Quartzite	32.90	38.15	10.45	Thin Biface
1073-79/S/21	Mudstone	29.10	29.70	5.55	Thin Biface
1073-30	Quartzite	31.15	32.00	8.25	Thin Biface
Medial					
193-1	Mudstone	43.05	32.10	11.80	Thin Biface
364-24	Mudstone	22.40	26.25	9.40	Thin Biface
392-11	Mudstone	23.05	40.40	11.20	Thin Biface

Table D-11. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Medial					
1054-416	Mudstone	57.65	31.95	8.45	Thin Biface
1054-1378	Mudstone	23.55	24.30	6.70	Thin Biface
1054-1416	Mudstone	25.50	42.60	7.75	Thin Biface
1054-1446	Mudstone	14.90	22.55	6.70	Thin Biface
1054-1447	Mudstone	36.95	41.50	3.95	Thin Biface
Undetermined					
656-9	Mudstone	31.15	27.05	7.70	Thin Biface
711-5	Mudstone	64.35	28.65	13.40	Thin Biface
1054-75	Mudstone	38.50	8.60	6.50	Thin Biface
1054-110	Mudstone	18.90	20.80	5.70	Thin Biface
1054-255	Mudstone	18.55	17.85	6.00	Thin Biface
1054-313	Quartzite	54.10	20.00	9.00	Thin Biface
1054-399	Mudstone	61.50	22.70	9.30	Thin Biface
1054-415	Mudstone	53.90	29.60	6.95	Thin Biface
1054-437	Quartzite	35.85	25.00	8.65	Thin Biface
1054-438	Mudstone	42.30	16.30	9.70	Thin Biface
1054-1227	Mudstone	43.80	22.45	14.40	Thin Biface
1054-1228	Mudstone	27.65	13.50	5.90	Thin Biface
1054-1232	Mudstone	33.65	17.60	9.40	Thin Biface
1054-1299	Mudstone	19.20	21.20	4.95	Thin Biface
1054-1393	Mudstone	32.80	18.75	5.75	Thin Biface
1054-1420	Mudstone	31.85	25.90	6.80	Thin Biface
1054-1422	Quartzite	25.90	24.55	9.30	Thin Biface
1058-250	Mudstone	39.90	30.30	9.60	Thin Biface
1058-251	Mudstone	20.65	12.00	4.90	Thin Biface
1058-284	Mudstone	23.80	12.50	10.30	Thin Biface
1059-5	Mudstone	41.15	11.60	5.70	Thin Biface
1060-12	Mudstone	35.15	25.25	8.70	Thin Biface
1060-36	Mudstone	58.50	34.85	11.35	Thin Biface
1074-12	Mudstone	35.15	18.90	6.15	Thin Biface

Fragments (N=122)

The Biface III fragments have been divided into a series of subclasses based on the shape or morphology of the fragments. These are similar to most of those in the LAURD collection termed unnotched bifaces, Group F or nondiagnostic fragments (Roll and Smith 1982).

There are 64 ovoid-rectangular end fragments (Table D-10). Mudstone is the most common material, followed by quartzite, with chert being the least common. The quartzite examples tend to be well made; they are relatively thin with no cortex. These fragments range in size from medium to small, but if complete they would have been quite large. The very fine grain mudstone fragmentary bifaces are similiar to the quartzite pieces with regard to size, flaking patterns, and the absence of cortex. Three of them (24LN1054-307, 24LN1054-261, and 24LN1054-442) may be heat treated. Three biface fragments are made from the white opaque fossiliferous chert material; they are small and irregularly flaked. Finally, one fragment (24LN443-7) is made of a black translucent chert ("Top-of-the-World") with numerous inclusions, and another (24LN656-8) is of white opaque chert. The ovoid to rectangular fragments appear to be the basal ends of large to medium size preforms. Many of these items were used as tools as evidenced by macroscopically detectable edge wear.

There are 26 pointed end fragments (Table D-11). These tend to be either assymetrical or thicker than the distal ends of projectile points. assymetrical. The quartzite artifacts range in size from small to medium; they are well flaked and do not retain cortex. Only two of the fragments seem to come from small bifaces. There are five very fine grain, black mudstone fragments, two of which appear to be broken in manufacture. Four are medium in size and the other is small, none have cortex. One (24LN1060-15) appears to be heat treated.

The remaining fragments are either medial sections (N=8) or fragments representing an undetermined portion of a biface (N=24). The medial fragments tend to be small in size, but probably represent all sizes in the Biface III class (Table D-11). Only one of the fragments (24LN1054-415) appears to be heat treated.

Biface IV

Biface IVs (N=38) have been pressure flaked and thus, are not considered to be "preforms". They may be end products used for a variety of tasks or they may be unfinished (i.e., unnotched) projectile points. These bifaces do not appear to have been used as projectile points (as defined here), as there is no evidence of hafting elements. The class is subdivided into a number of subclasses based on shape.

Table D-10. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Ovoid/Rectangular Fragment					
387-8	Quartzite	59.55	34.15	14.20	Thin Biface
388-12	Mudstone	31.95	38.65	10.95	Thin Biface
388-13	Quartzite	37.70	56.95	10.20	Thin Biface
388-19	Quartzite	41.00	68.25	12.75	Thin Biface
388-216	Mudstone	56.75	38.30	10.40	Thin Biface
392-4	Mudstone	46.75	35.60	11.00	Thin Biface
402-4	Mudstone	34.40	21.35	7.15	Thin Biface
402-6	Mudstone	36.40	21.50	11.70	Thin Biface
443-2	Mudstone	27.80	28.80	7.35	Thin Biface
443-7	Chert	33.00	17.10	6.40	Thin Biface
656-8	Chert	23.35	33.75	7.80	Thin Biface
665-1	Chert	21.50	27.65	6.25	Thin Biface
697-1	Mudstone	27.00	28.15	7.60	Thin Biface
1054-6	Mudstone	31.00	26.70	6.40	Thin Biface
1054-9	Mudstone	38.35	36.75	8.65	Thin Biface
1054-19	Chert	30.10	13.75	5.35	Thin Biface
1054-37	Mudstone	45.55	42.25	10.85	Thin Biface
1054-107	Quartzite	27.90	42.05	10.00	Thin Biface
1054-108	Other	44.05	29.15	8.20	Thin Biface
1054-116	Mudstone	21.75	42.95	7.65	Thin Biface
1054-133	Mudstone	50.80	33.35	10.45	Thin Biface
1054-216	Mudstone	41.80	32.15	8.70	Thin Biface
1054-226	Mudstone	44.00	49.30	11.80	Thin Biface
1054-234	Quartzite	29.15	25.85	8.65	Thin Biface
1054-236	Chert	24.20	31.20	5.30	Thin Biface
1054-245	Mudstone	38.95	29.70	7.95	Thin Biface
1054-257	Mudstone	25.30	30.50	5.60	Thin Biface
1054-261	Mudstone	33.15	34.50	7.55	Thin Biface
1054-307	Mudstone	59.10	36.30	9.60	Thin Biface
1054-312	Quartzite	44.90	29.80	8.45	Thin Biface

Table D-10. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Ovoid/Rectangular Fragment					
1054-315	Quartzite	28.75	38.20	8.10	Thin Biface
1054-369	Mudstone	20.00	24.55	7.35	Thin Biface
1054-390	Mudstone	25.00	35.25	8.25	Thin Biface
1054-396	Mudstone	11.35	27.75	5.05	Thin Biface
1054-442	Mudstone	27.95	13.35	5.60	Thin Biface
1054-443	Other	16.15	25.70	6.55	Thin Biface
1054-1237	Mudstone	43.80	38.45	15.95	Thin Biface
1054-1259	Quartzite	25.90	38.55	11.75	Thin Biface
1054-1268	Mudstone	39.25	30.50	5.75	Thin Biface
1054-1321	Mudstone	39.45	46.50	8.20	Thin Biface
1054-1389	Mudstone	31.40	53.15	10.10	Thin Biface
1054-79/S/2	Quartzite	31.85	44.25	7.35	Thin Biface
1055-3	Other	42.35	41.10	6.90	Thin Biface
1055-9	Quartzite	45.30	55.95	9.85	Thin Biface
1055-16	Quartzite	32.50	34.85	9.60	Thin Biface
1058-10	Mudstone	22.20	32.20	11.10	Thin Biface
1059-1	Quartzite	43.30	36.25	9.15	Thin Biface
1059-14	Mudstone	41.80	38.25	10.25	Thin Biface
1059-16	Mudstone	24.35	32.70	6.40	Thin Biface
1059-17	Quartzite	50.80	37.40	14.40	Thin Biface
1059-18	Quartzite	58.00	32.15	9.15	Thin Biface
1070-1	Mudstone	30.00	22.70	7.45	Thin Biface
1073-79/S/8	Mudstone	46.60	54.15	12.65	Thin Biface
1073-79/S/19	Mudstone	42.45	34.50	7.50	Thin Biface
1073-79/S/28	Quartzite	41.85	53.20	11.05	Thin Biface
1073-79/S/40	Quartzite	48.65	45.15	13.40	Thin Biface
1073-79/S/49	Mudstone	25.90	40.00	7.50	Thin Biface
1074-22	Mudstone	50.90	40.35	9.35	Thin Biface
1074-27	Mudstone	56.80	31.40	8.20	Thin Biface
1086-3	Mudstone	30.80	47.90	10.50	Thin Biface

Table D-9. Metric (mm) and Material Type Attributes for Morpho/Techno Class Biface III, Subclasses: Lanceolate (N=4) and Triangular (N=15).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Lanceolate					
191-79/S/3	Mudstone	70.30	34.45	9.15	Thin Biface
1054-294	Mudstone	105.90	38.55	14.55	Thin Biface
1056-3	Mudstone	77.95	33.75	13.15	Thin Biface
1076-4	Mudstone	87.00	36.45	9.25	Thin Biface
Triangular					
193-1	Mudstone	43.05	32.10	11.80	Thin Biface
366-1	Quartzite	54.50	35.10	10.80	Thin Biface
375-4	Mudstone	48.55	33.45	10.05	Thin Biface
692-1	Mudstone	40.65	27.85	6.05	Thin Biface
1054-26	Mudstone	60.20	31.45	17.35	Thin Biface
1054-72	Mudstone	49.05	30.60	9.35	Thin Biface
1054-254	Mudstone	34.45	24.55	9.80	Thin Biface
1054-270	Mudstone	58.50	31.50	14.50	Thin Biface
1054-286	Quartzite	55.85	34.05	8.95	Thin Biface
1054-308	Mudstone	54.65	39.95	13.30	Thin Biface
1054-320	Mudstone	52.35	37.80	10.40	Thin Biface
1054-406	Mudstone	44.10	26.10	8.50	Thin Biface
1054-433	Quartzite	46.30	32.65	8.65	Thin Biface
1054-1220	Mudstone	53.65	23.45	14.80	Thin Biface
1058-7	Mudstone	48.50	32.10	10.40	Thin Biface

Table D-10. Metric (mm) and Material Type Attributes for Morpho/Techno Class Biface III, Subclasses: Ovoid/Rectangular (N=25) and Ovoid/Rectangular Fragments (N=64).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Ovoid/Rectangular					
193-79/S/9	Mudstone	55.40	39.20	12.60	Thin Biface
366-4	Mudstone	24.30	45.10	7.15	Thin Biface
388-11	Mudstone	45.55	31.75	8.05	Thin Biface
388-15	Mudstone	43.85	34.75	11.85	Thin Biface
392-7	Mudstone	67.85	34.20	15.00	Thin Biface
394-3	Mudstone	79.00	39.55	9.10	Thin Biface
399-4	Mudstone	34.30	28.90	6.30	Thin Biface
1054-2	Mudstone	77.85	37.85	13.20	Thin Biface
1054-8	Chert	32.00	25.70	7.40	Thin Biface
1054-283	Quartzite	69.15	34.10	14.55	Thin Biface
1054-309	Mudstone	57.80	37.75	11.40	Thin Biface
1054-311	Quartzite	68.00	36.45	11.25	Thin Biface
1054-466	Mudstone	77.40	44.70	10.40	Thin Biface
1054-1214	Quartzite	46.35	38.00	13.95	Thin Biface
1054-1216	Mudstone	63.00	41.55	9.45	Thin Biface
1054-1241	Mudstone	66.15	38.55	12.90	Thin Biface
1054-1262	Mudstone	90.15	45.60	16.55	Thin Biface
1054-1265	Mudstone	50.75	30.70	10.20	Thin Biface
1054-1424	Mudstone	49.80	34.30	10.85	Thin Biface
1054-1426	Mudstone	51.70	42.65	10.60	Thin Biface
1058-261	Mudstone	40.15	34.75	10.55	Thin Biface
1073-79/S/14	Mudstone	51.45	41.40	12.45	Thin Biface
1073-79/S/18	Mudstone	47.20	30.55	7.85	Thin Biface
1076-3	Quartzite	48.40	48.90	11.40	Thin Biface
1096-1	Mudstone	46.20	37.20	9.15	Thin Biface
Ovoid/Rectangular Fragment					
364-19	Mudstone	46.80	37.65	11.75	Thin Biface
364-26	Mudstone	12.00	23.00	6.70	Thin Biface
365-2	Quartzite	56.75	50.05	12.60	Thin Biface
387-2	Mudstone	24.85	40.25	11.30	Thin Biface

judging from the fact that fractures tend to be perverse and bending. This subclass includes three small artifacts made from a white, opaque fossiliferous chert. It should be noted that only one of the subclasses of artifacts previously described contain any chert or chert-like specimens.

Biface III

This class (N=166) consists of those bifaces and fragments which could be called "preforms" as well as those that are probably finished tools. The term "preform" indicates that the artifact has been thinned and is ready for pressure flaking or final edge modification. Many of these bifaces could have been used as knives or other tools without further modification in the form of pressure flaking. These bifaces are less than or equal to 1.5 cm thick; the margins are relatively straight, there are regular (i.e., patterned) flake scars, generally oriented from one margin toward the opposite one. The class is subdivided based on shape.

Triangular (N=15)

The bifaces in this subclass (Figure 8-8, a-f) tend to have three edges. There are 14 black to grey mudstone bifaces and two quartzite bifaces (Table D-9). None exhibit cortex. Two of the black mudstone bifaces (24LN1054-254 and 320) may be heat treated. Four black mudstone bifaces (24LN1054-406, 24LN1054-72, 24LN366-1 and 24LN692-1) and one quartzite biface (24LN1054-286) were made on flakes. Triangular Biface IIIs are much like the unnotched bifaces, Group B--large triangular points--specimens, in the LAURD collection (Roll and Smith 1982).

Lanceolate (N=4)

All of these large, long bifaces (Figure 8-7, a-d) are made of mudstone. Two of them may be heat treated. They appear to be made on long thin flakes and there is no evidence of cortex. These specimens are similar to those in the LAURD collection classified as unnotched bifaces, Group C or large lanceolate bifaces (Roll and Smith 1982).

Ovoid-Rectangular (N=25)

Bifaces in this subclass (Figure 8-7, e-h) tend to have four edges. Most are made from various mudstones, but quartzite is well represented (Table D-10). Two of the mudstone bifaces (24LN1054-466 and 24LN392-7) appear to have been made on thinning flakes as evidenced by their longitudinal cross sections. One (24LN399-4) may be heat treated. In general, mudstone bifaces are thinner and more extensively flaked than the quartzite examples. Many of the specimens in this subclass would be considered biface preforms if they were in the LAURD collection (Roll and Smith 1982).

Table D-8. Metric (mm) and Material Type Attributes for Morpho/Techno Class Nonhaft Biface II, Subclass: Fragments (N=51).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
190-23	Mudstone	20.05	35.20	10.45	Thick Biface
193-3	Mudstone	34.65	51.55	15.70	Thick Biface
364-5	Mudstone	37.55	42.70	13.85	Thick Biface
364-25	Mudstone	56.75	25.20	15.30	Thick Biface
366-20	Quartzite	58.50	41.20	18.60	Thick Biface
382-2	Mudstone	42.25	51.90	22.30	Core
388-20	Quartzite	41.75	59.55	17.90	Core
399-1	Mudstone	36.10	45.20	13.80	Thick Biface
419-1	Mudstone	54.80	42.65	14.20	Thick Biface
423-59	Mudstone	24.35	28.00	11.55	Thick Biface
704-6	Mudstone	50.85	35.20	18.40	Thick Biface
1054-24	Quartzite	82.50	62.75	20.05	Thick Biface
1054-38	Mudstone	52.95	39.30	17.15	Thick Biface
1054-68	Quartzite	29.60	45.00	14.00	Thick Biface
1054-176	Quartzite	77.80	41.80	15.80	Thick Biface
1054-262	Mudstone	27.90	41.20	14.80	Thick Biface
1054-272	Other	17.00	40.00	11.20	Thick Biface
1054-275	Mudstone	47.00	27.00	12.45	Thick Biface
1054-276	Quartzite	55.00	76.10	21.35	Core
1054-323	Mudstone	22.20	35.00	9.85	Thick Biface
1054-425	Mudstone	27.35	66.80	14.25	Thick Biface
1054-448	Mudstone	45.70	42.75	15.20	Thick Biface
1054-459	Quartzite	68.80	85.90	29.75	Core
1054-484	Mudstone	28.20	44.55	12.55	Thick Biface
1054-548	Mudstone	38.85	54.80	14.15	Thick Biface
1054-1227	Mudstone	43.80	22.45	14.40	Core
1054-1263	Quartzite	67.25	34.05	11.05	Core
1054-1294	Mudstone	63.55	40.65	12.35	Thick Biface
1054-1388	Mudstone	45.85	41.50	14.75	Thick Biface

Table D-8. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1421	Quartzite	39.25	20.75	8.35	Thick Biface
1054-1423	Mudstone	67.90	38.70	13.60	Thick Biface
1054-1425	Mudstone	60.00	37.75	20.85	Core
1054-1427	Quartzite	48.15	59.05	17.30	Thick Biface
1054-1436	Mudstone	48.95	24.05	11.60	Thick Biface
1055-14	Quartzite	40.90	54.35	17.20	Thick Biface
1055-19	Quartzite	67.40	85.20	26.50	Thick Biface
1057-7	Quartzite	42.05	33.75	13.30	Thick Biface
1058-19	Mudstone	52.40	35.85	15.00	Thick Biface
1058-20	Mudstone	68.15	53.35	17.30	Thick Biface
1059-12	Quartzite	59.75	48.65	16.55	Core
1059-13	Quartzite	39.05	76.85	21.05	Core
1059-46	Quartzite	36.40	56.75	14.75	Core
1073-7	Mudstone	47.40	49.90	18.30	Thick Biface
1073-31	Mudstone	72.75	33.85	11.25	Thick Biface
1073-79/S/44	Mudstone	50.50	48.75	15.50	Thick Biface
1073-79/S/45	Mudstone	46.20	28.35	19.15	Core
1073-46	Quartzite	76.40	40.70	24.20	Core
1073-275	Quartzite	37.25	51.90	15.00	Thick Biface
1087-7	Other	37.60	30.00	8.80	Thick Biface
1087-9	Other	37.95	30.10	14.95	Thick Biface
1144-3	Mudstone	56.95	30.55	12.50	Thick Biface

Table D-7. Metric (mm) and Material Type Attributes for Morpho/Techno Class Nonhaft Biface II, Subclasses: Triangular (N=9) and Ovoid/Rectangular (N=32).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Triangular					
364-12	Mudstone	76.00	54.75	22.00	Thick Biface
381-1	Quartzite	80.50	53.20	24.80	Thick Biface
394-5	Mudstone	40.10	30.00	13.65	Thick Biface
656-2	Mudstone	53.50	40.20	17.75	Thick Biface
1054-271	Quartzite	54.25	39.30	16.00	Thick Biface
1054-404	Mudstone	61.75	41.00	21.40	Thick Biface
1054-467	Mudstone	65.00	39.10	23.80	Core
1054-1266	Mudstone	43.85	33.60	16.90	Core
1057-2	Quartzite	70.05	56.00	24.70	Core
Ovoid/Rectangular					
376-4	Mudstone	70.65	42.10	18.15	Thick Biface
387-12	Mudstone	52.65	37.05	17.55	Thick Biface
388-29	Quartzite	50.00	45.15	23.25	Core
419-2	Mudstone	80.85	58.65	18.90	Thick Biface
656-184	Quartzite	84.85	52.75	22.25	Thick Biface
1054-17	Mudstone	61.45	42.10	16.25	Thick Biface
1054-19	Quartzite	64.45	52.70	15.30	Core
1054-27	Mudstone	65.60	38.50	23.55	Core
1054-134	Quartzite	58.30	46.75	46.80	Thick Biface
1054-282	Mudstone	71.40	43.70	16.95	Thick Biface
1054-300	Quartzite	71.90	61.40	24.30	Core
1054-333	Quartzite	35.90	31.15	14.55	Core
1054-401	Quartzite	83.10	52.85	23.80	Thick Biface
1054-423	Mudstone	43.40	34.45	14.00	Thick Biface
1054-468	Mudstone	63.75	44.60	18.05	Core
1054-1246	Mudstone	113.55	62.25	17.90	Thick Biface
1054-1251	Mudstone	70.35	59.25	24.65	Thick Biface
1054-1320	Mudstone	123.30	73.25	35.35	Core
1054-1326	Quartzite	79.70	64.70	27.00	Core

Table D-7. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Ovoid/Rectangular					
1055-2	Quartzite	49.05	35.00	18.45	Thick Biface
1058-254	Quartzite	79.70	78.75	36.10	Thick Biface
1058-262	Mudstone	35.65	32.80	13.90	Core
1058-266	Mudstone	67.20	46.40	21.50	Core
1059-31	Mudstone	69.30	69.10	26.60	Thick Biface
1059-32	Mudstone	67.00	53.00	34.40	Thick Biface
1060-8	Quartzite	72.10	55.20	22.40	Thick Biface
1060-45	Quartzite	74.65	57.40	32.35	Core
1073-12	Other	42.30	27.70	15.10	Thick Biface
1073-79/S/15	Mudstone	90.30	46.65	12.30	Thick Biface
1073-79/S/29	Mudstone	53.90	46.45	12.30	Thick Biface
1073-29	Mudstone	54.00	48.50	29.20	Core
1086-1	Mudstone	73.05	34.50	14.00	Thick Biface

and only a few flakes removed. The flaked margin appears battered. Two other bifaces are coarser grain mudstone, medium size cobbles with 51-75 percent cortex and only a few flakes removed.

Biface II

This class of bifaces (N=92) is distinguished from the Biface I by having less sinuous to almost straight margins. The Biface IIs are thinner--between 3.5 and 1.5 cm thick--but also have nonpatterned (i.e., irregular) flake scars. The class is subdivided by shape into three subclasses. Biface IIs are like the biface preforms in the LAURD collection (Roll and Smith 1982).

Triangular (N=9)

These are bifaces (Figure 8-6, a-e) with three edges. The quality of raw material tends to be poor, as evidenced by the many flake scars that terminate as step fractures. One artifact (24LN394-5) appears to have been heat treated.

Ovoid-Rectangular (N=32)

Between this subclass (Figure 8-6, f-i) and the triangular subclass there is some overlap. Ideally, any rounded bifaces or bifaces with four sides/ends are classed as ovoid-rectangular, while all those with three sides/ends are in the triangular subclass. In the ovoid-rectangular class (Table D-7) there are twelve quartzite bifaces, one other, and various mudstone specimens. In general, material types are of poor quality due to their platy nature. One of these bifaces (24LN1054-423) may have been heat treated. Interestingly, the quartzite specimens seem to flake better, in that they do not exhibit the large numbers of stacked step fractures evident on the mudstone bifaces.

Fragments (N=51)

This subclass includes all Biface II fragments (Table D-8). Eighteen are quartzite (seven medium sized, eleven small) and none have cortex. With this material it is difficult to judge whether breakage might result from skill of the knapper, raw material flaws, or use. There are 12 very fine grain mudstone artifacts in this subcategory; two are medium size. The rest are small. One of these bifaces, (24LN419-1) is made on a flake; one (24LN364-5) is burned and has potlids. One (24LN1054-262) is made of a very fine grain, high quality mudstone with inclusions; it may be heat treated. The others are not well flaked and exhibit stacked step fractures; most appear broken in manufacture. There are 18 black fine grain mudstone fragments, one (24LN364-25) of which may be heat treated. Six are medium size and the other 12 are small; none of them have cortex. Most are made from poor quality material; most of the breaks appear to have occcurred during manufacture

Table D-6. Metric (mm) and Material Type Attributes for Morpho/ Techno Class Nonhaft Biface I, Subclasses: Complete (N=22) and Partial (N=7).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Complete					
365-19	Quartzite	186.00	107.35	41.40	Thick Biface
388-56	Quartzite	104.25	87.05	56.30	Core
388-57	Quartzite	140.45	123.00	87.30	Core
394-6	Quartzite	189.00	175.00	52.20	Core
394-11	Quartzite	97.40	91.05	45.70	Thick Biface
656-193	Quartzite	105.50	84.65	53.55	Core
665-2	Quartzite	176.00	138.05	75.00	Core
1054-132	Quartzite	97.10	76.00	41.55	Core
1054-205	Quartzite	170.00	129.75	60.85	Core
1054-209	Quartzite	92.85	84.50	40.30	Core
1054-278	Quartzite	99.80	81.75	38.40	Thick Biface
1054-326	Quartzite	78.90	62.15	27.40	Thick Biface
1054-456	Quartzite	85.90	70.00	46.90	Core
1054-1327	Mudstone	62.30	59.05	23.85	Thick Biface
1054-1331	Quartzite	70.00	62.05	38.65	Core
1054-1340	Mudstone	63.05	54.55	41.50	Core
1073-79/S/32	Mudstone	86.50	81.90	52.30	Core
1073-79/S/33	Mudstone	91.80	89.15	44.00	Core
1073-254	Mudstone	75.70	56.38	22.10	Core
1074-7	Quartzite	81.60	73.80	51.05	Core
IA-29	Mudstone	69.25	54.40	20.70	Thick Biface
IA-36	Mudstone	58.25	52.65	32.60	Thick Biface
Partial					
364-31	Quartzite	83.00	63.05	45.15	Core
387-31	Mudstone	71.35	70.80	48.45	Core
388-3	Mudstone	65.75	49.40	31.00	Thick Biface
388-22	Quartzite	177.00	167.00	78.00	Core
388-36	Mudstone	181.20	72.30	52.95	Thick Biface
676-1	Quartzite	81.80	97.45	35.75	Core
1074-9	Quartzite	108.30	88.40	50.05	Thick Biface

Grinding: basal and lateral edges of haft element may be slightly ground for two specimens (24LN1054-34 and 24LN1072-1)
Type of blank: probably flakes (7); biface blanks or larger flakes (6)
Similar to: Shaunavon Truncated-base variety of Prairie Side-Notched
Time period: Late Prehistoric Period

Small, Corner to Side-Notched Projectile Points (Figure 8-10, q-t)

Summary Outline (N=6)
Blade Shape: triangular
Cross section: biconvex (4); plano-convex (2)
Shoulders: distinct
Haft element points of juncture: lateral-basal to lateral-coincidental
Haft element characteristic: assymetrical
Notch characteristic: wide and deep
Basal edge characteristic: convex (4); almost straight (2)
Flaking: Primary flaking is obscured largely by irregular, expanding and conchoidal secondary flake scars that tend to be bifacial. The two plano-convex specimens are flaked only along margins of ventral surfaces.
Grinding: not evident
Type of blank: probably flakes
Similar to: Samanth Side-Notched, Columbia Valley Corner-Notched, and Head-Smashed-In Corner-Notched
Time Period: Late Prehistoric Period

Small, Corner-Notched, Barbed Projectile Points (Figure 8-10, g-k)

Summary Outline (N=11)
Blade shape: triangular to excurvate
Cross section: plano-convex (7); biconvex (4)
Shoulders: very distinct, near right angles to sloping
Haft element points of juncture: lateral-basal (8); lateral-coincidental (3)
Haft element characteristic: prominent barbs and rapidly expanding haft elements
Notch characteristic: deeper than wide
Basal edge characteristic: straight to slightly convex
Flaking: Primary flake scars, when evident, are confined mainly to one face. Expanding, conchoidal and lamellar secondary flake scars tend to be bifacial and invasive.
Grinding: not evident
Type of blank: probably flakes
Similar to: Blue Dome, Mummy Cave Corner-Notched, and Pelican Lake-Elko
Time Period: Late Prehistoric Period

Table D-16. Metric (mm) and Material Type Attributes for Small Corner to Side-Notched Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
(365)192-79/S/2	Blk, Opq, Mud	21.6	14.4	3.4	14.4	11.9	8.9	4.5	14.9	6.7
1054-30	Bwn, Opq, Mud	20.9	19.1	3.2	19.1	10.0	8.8	6.1	14.3	6.6
1056-7	Blk, Opq, Mud	19.8	13.2	4.5	13.2	10.9	8.7	6.2	11.8	8.0
1059-41	Blk, Opq, Mud	15.2	10.3	3.2	10.0	10.3	6.6	4.0	8.2	7.0
1073-18	Gry, Opq, Cht	28.0	13.7	3.1	13.7	10.5	8.2	4.6	21.7	6.3
1073-243	Blk, Opq, Mud	-17.0	13.0	3.9	13.0	10.7	7.8	4.2	10.4	6.6
Total (6)										
Mean		20.4	14.0	3.6	13.9	10.7	8.2	4.9	13.4	6.9
Std Dev		4.4	2.9	0.5	3.0	0.7	0.9	1.0	5.2	0.6

Table D-17. Metric (mm) and Material Type Attributes for Small, Corner-Notched, Barbed Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Wi :h	Blade Length	Base Length	Class/ Sub-Class
364-1	Blk,Opq,Mud	27.4	-18.0	4.0	-18.0	12.3	9.5	-2.5	-22.5	5.5	-
386-3	Blk,Opq,Mud	-41.0	17.2	3.8	17.2	-11.5	8.4	3.5	-36.7	6.0	-
684-1	Bwn,Tns,Cht	23.7	18.3	4.4	18.3	-14.0	8.6	4.6	17.2	7.1	-
1054-79/S/4	Blk,Opq,Mud	-32.0	19.1	3.9	19.1	-12.5	9.1	5.0	26.4	6.9	-
1054-287	Blk,Opq,Mud	-36.0	20.5	5.7	20.5	-12.5	6.7	4.8	30.6	8.0	-
1054-418	Blk,Opq,Mud	-30.0	16.4	3.7	16.4	13.6	8.7	5.0	-23.0	8.0	-
1073-W-3	Blk,Opq,Mud	-25.0	-18.0	2.9	-13.0	-14.0	7.7	4.1	-20.3	6.4	-
1074-24	Blk,Opq,Mud	-29.0	17.5	4.6	17.5	13.3	3.3	3.3	-22.8	7.2	-
Sub-total (8)											
Mean		30.5	18.1	4.1	18.1	13.0	8.4	4.1	24.9	6.9	
Std Dev		5.7	1.2	0.8	1.2	0.9	0.9	0.9	6.2	0.9	
706-4	Gry,Opq,Cht	--	-17.0	4.1	-17.0	--	-8.5	--	-28.0	--	Frag.
706-9	Bwn,Opq,Cht	--	17.0	5.0	17.0	--	-9.5	--	26.4	--	Frag.
IA-1	Blk,Opq,Mud	--	18.8	4.9	18.9	--	-9.0	--	-30.0	--	Frag.
Sub-total (3)											
Mean			17.6	4.7	17.6		9.0		28.1		
Std Dev			1.0	0.5	1.0		0.5		1.8		
Totals (11)											
Mean		30.5	18.0	4.3	18.0	13.0	8.5	4.1	25.8	6.9	
Std Dev		5.7	1.2	0.8	1.2	0.90	0.8	0.9	5.4	0.9	

Small (Arrow Size) Projectile Point Fragments

Summary Outline (N=7)

Comments: Maximum thicknesses and widths of these items, as well as minimum tang widths, fall within the size ranges of specimens considered to be arrow points. In addition, the morphological and technological attributes of these specimens are more like those in the arrow point sample than they are like the larger, dart size specimens.

Flaking: Flake scars tend to be small and uniform. Flaking is marginal on one face.

Time period: Late Prehistoric Period

Large, Corner-Notched, Barbed Projectile Points (Figure 8-12, c-j)

Summary Outline (N=15)

Comments: This subclass includes all comparatively large corner-notched and barbed projectile points. It has been divided into three subtypes. Subtype c includes all fragments, but judging from their overall size and morphology they probably represent specimens like those in subtype a.

Similar to: Pelican Lake and Northern Rocky Mountain Convex Base, Corner-Notched

Time period: late Middle Prehistoric Period

Subtype a (N=8), Figure 8-12, c-h

Blade shape: triangular (7); excurvate (1)
Cross section: plano-convex (4); biconvex (4)
Shoulders: very distinct
Haft element points of juncture: lateral-basal
Haft element characteristic: expanding
Notch characteristic: relatively deep but widths vary considerably
Basal edge characteristic: slightly convex to straight
Flaking: Primary flaking is obscured largely by extensive and uniform bifacial flake scars that are expanding and conchoidal.
Grinding: readily apparent on the basal edge in only one specimen (24LN423-64)
Type of blank: probably large flakes

Subtype b (N=2), Figure 8-12, i-j

Blade shape: excurvate
Cross section: plano-convex
Shoulders: very distinct
Haft element points of juncture: lateral-basal
Haft element characteristic: short in comparison to blade length
Basal edge characteristic: concave

Table D-18. Metric (mm) and Material Type Attributes for Small--Arrow Size--Projectile Point Fragments.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Length	Blade Length	Base Length	Frag. Type
366-10	Blk,Opq,Mud	--	--	2.1	~14.5	--	~7.0	--	21.4	--	Comp. Blade
397-1	Blk,Tns,Cht	--	--	2.8	13.5	--	~6.5	--	~18.0	--	Comp. Blade
417-4	Gry,Tns,Cht	--	--	2.9	--	--	--	--	--	--	Tip Only
656-4	Gry,Tns,Cht	--	--	2.5	12.7	--	9.3	--	15.3	--	Comp. Blade
715-1	Blk,Opq,Mud	--	--	2.5	14.0	--	~8.5	--	~15.0	--	Comp. Blade
1054-219	Wht,Opq,Cht	--	--	2.8	--	--	--	--	--	--	Tip Only
1054-436	Blk,Opq,Cht	--	--	3.2	--	--	--	--	--	--	Tip Only
Total (7)											
Mean				2.7	14.0		7.3				
Std Dev				0.4	0.5		1.0		75.2		

Table D-19. Metric (mm) and Material Type Attributes for the Large, Corner-Notched, Barbed Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Sub-Class
193-79/S/1	Bwn,Opq,Mud	~45.0	27.5	4.6	27.5	17.7	13.1	5.3	~40.9	9.0	a
375-2	Red,Opq,Cht	51.6	30.1	7.5	30.1	19.1	13.5	8.1	42.0	11.5	a
388-212	Gry,Opq,Mud	53.2	~25.0	5.2	~25.0	18.7	16.0	2.8	46.3	9.7	a
389-1	Blk,Tns,Cht	36.6	19.2	4.8	19.2	14.8	11.1	~3.0	29.0	7.0	a
423-64	Blk,Opq,Mud	~43.0	23.5	6.4	23.5	~18.0	12.3	5.0	35.5	9.5	a
1073-I-79/S/4	Gry,Opq,Cht	43.8	23.0	5.1	23.0	16.0	12.5	5.1	36.1	8.3	a
1074-6	Blk,Tns,Cht	33.3	21.2	4.7	21.2	12.8	11.1	3.7	28.1	6.7	a
IA-7	Wht,Opq,Cht	~35.0	19.4	6.1	19.4	~14.5	10.9	~4.5	~28.3	7.2	a
Sub-total (8)											
Mean		42.7	24.2	5.6	23.6	16.4	12.6	4.9	35.8	8.5	
Std Dev		7.4	3.6	1.0	3.8	2.3	1.7	1.6	6.9	1.6	
189-79/S/2	Grn,Opq,Mud	56.3	31.1	7.5	31.1	20.8	14.7	7.3	48.6	9.8	b
364-21	Bwn,Opq,Mud	49.2	29.9	8.1	29.9	15.0	14.0	6.1	45.8	6.0	b
Sub-total (2)											
Mean		52.8	30.5	7.8	30.5	17.9	14.4	6.7	47.2	7.9	
Std Dev		5.0	0.8	0.4	0.8	4.1	0.5	0.8	2.0	2.7	
706-5	Gry,Tns,Cht	--	21.3	6.1	21.3	--	12.4	--	~35.0	--	c
711-8	Grn,Opq,Mud	--	--	5.0	--	--	--	--	--	--	c
1054-1419	Blk,Opq,Mud	--	19.8	5.7	19.3	--	12.4	--	30.5	--	c
IA-4	Blk,Tns,Cht	--	~27.5	5.3	~27.5	--	~15.0	--	~39.0	--	c
IA-13a	Gry,Opq,Cht	--	25.3	6.4	25.3	--	~14.0	--	30.9	--	c
Sub-total (5)											
Mean			23.5	5.7	23.4		13.4		33.8		
Std Dev			3.5	0.6	3.7		1.3		4.0		
Total (15)											
Mean		44.7	24.5	5.9	24.5	16.7	13.1	5.3	36.8	8.4	
Std Dev		7.9	4.1	1.1	4.2	2.5	1.5	1.7	7.0	1.7	

Table D-20. Metric (mm) and Material Type Attributes for Large, Short Stemmed Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
190-12	Bwn, Opq, Cht	--	--	--	--	15.5	10.5	4.4	--	7.1
369-2	Blk, Opq, Mud	--	18.8	3.2	18.8	15.5	11.6	4.9	--	6.4
369-3	Blk, Opq, Mud	34.4	16.8	3.8	16.8	15.4	11.7	4.4	26.5	6.3
1054-220	Blk, Opq, Mud	21.4	--	5.5	19.4	17.7	13.1	5.0	--	8.0
1073-244	Blk, Opq, Mud	21.6	17.8	5.4	17.3	15.5	12.8	3.9	14.4	7.2
Total (5)										
Mean		25.8	17.8	4.5	18.2	15.9	11.9	4.5	20.5	7.0
Std Dev		7.4	1.0	1.2	1.1	1.0	1.0	0.4	8.6	0.7

Flaking: Primary flaking is bifacial and extensive. Secondary flake scars are uniform, expanding and conchoidal in shape and tend to be confined to the margins.
Grinding: the basal edge of one specimen (24LN189-79/S/2) is well ground
Type of blank: probably large flakes

Large, Short Stemmed Projectile Points (Figure 8-12, a-b)

Summary Outline (N=5)
Blade shape: triangular
Cross section: plano-convex (4); biconvex (1)
Shoulders: distinct, abrupt
Haft element points of juncture: lateral-coincidental (4); lateral-basal (1)
Notch characteristic: very distinct, near base, about as wide as deep
Basal edge characteristic: straight
Flaking: Secondary flake scars are uniform, expanding and conchoidal, bifacial, but more extensive on dorsal surface.
Grinding: not apparent
Type of blank: flakes, approximately size of finished product
Similar to: Besant Side Notched
Time period: probably late Middle Period

Large, Stemmed, Straight Base Projectile Points (Figure 8-11, m-o)

Summary Outline (N=4)
Blade shape: triangular
Cross section: biconvex (2); plano-convex (2)
Shoulders: very abrupt, near right angles
Haft element points of juncture: lateral-basal
Haft element characteristic: expanding to parallel lateral edges
Basal edge characteristic: straight
Flaking: Secondary flake scars are uniform expanding and conchoidal; they tend to be bifacial, but more extensive on one face than the other.
Grinding: not apparent
Type of blank: probably flakes considerably larger than final product
Similar to: Hanna Corner Notched or Pelican Lake Stemmed
Time period: late Middle Period

Table D-21. Metric (mm) and Material Type Attributes for Large Stemmed, Straight Base Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
(365)192-79/S/Y	Bwn, Opq, Cht	26.7	23.8	6.8	23.8	17.0	13.5	9.6	15.4	11.3
388-2	Blk, Opq, Mud	44.4	19.7	5.4	19.7	13.4	12.1	7.2	35.7	8.7
699-2	Gry, Opq, Cht	27.9	22.6	4.1	22.6	15.7	12.7	7.0	19.6	8.3
1060-16	Blk, Opq, Mud	25.9	21.0	5.8	21.0	12.5	12.5	7.2	16.5	9.4
Total (4)										
Mean		31.2	21.8	5.5	21.8	14.6	12.7	7.8	21.3	9.4
Std Dev		8.8	1.8	1.1	1.8	2.1	0.6	1.2	9.4	1.3

Table D-22. Metric (mm) and Material Type Attributes for Medium Corner to Side-Notched Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
688-2	Gry, Opq, Cht	~28.0	19.9	5.0	19.9	14.9	11.1	7.1	~19.7	8.3
1054-28	Blk, Opq, Mud	~30.0	15.9	5.9	15.9	15.1	10.2	5.5	~21.5	8.3
1073-245	Blk, Opq, Mud	29.2	15.1	5.1	15.1	13.0	10.0	4.6	21.0	8.2
1073-246	Blk, Opq, Mud	~32.0	18.3	4.8	18.3	13.7	10.4	4.8	~25.5	6.5
1073-79/S/6	Blk, Opq, Mud	35.3	15.9	5.4	15.9	14.1	10.2	6.0	26.1	9.2
1074-1	Red, Opq, Cht	31.2	17.7	5.5	17.7	12.0	9.8	5.8	23.1	8.1
1074-2	Bwn, Opq, Mud	32.0	18.3	5.4	18.3	14.4	9.5	4.8	23.0	9.0
IA-22	Blk, Tns, Cht	~38.0	17.0	6.1	17.0	12.7	9.9	7.2	~28.0	10.0
Total (8)										
Means		32.0	17.4	5.4	17.3	13.7	10.1	5.7	23.5	8.4
Std Dev		3.3	1.6	0.4	1.4	1.1	0.5	1.0	2.8	1.0

Medium Corner to Side-Notched Projectile Points Figure 8-11, g-l)

Summary Outline (N=8)

Blades: triangular, but two excurvate
Cross section: plano-convex (5); biconvex (3)
Shoulders: distinct, near right angles to sloping
Haft element points of juncture: lateral-coincidental to lateral-basal (one almost lateral-lateral)
Notch characteristic: wide, relatively deep
Basal edge characteristic: straight to slightly convex
Flaking: Secondary flake scars are expanding, conchoidal, extensive and bifacial in most cases; some pressure flaking or fine trimming is evident.
Grinding: not readily apparent, but slight basal grinding on one specimen (24LN688-2)
Type of blank: probably flakes, but several may be made from large flakes that were bifacially reduced.
Similar to: Pelican Lake Stemmed (maybe Salmon River Side-Notched)
Time period: late Middle Period (earlier if Salmon River Side Notched)

Large, Wide Notched Projectile Points (Figure 8-11, p-s)

Summary Outline (N=8)

Blade shape: excurvate (4); triangular (4)
Cross section: biconvex (5); biplano (2); plano-convex (1)
Shoulders: distinct, but sloping
Haft element points of juncture: lateral-coincidental
Notch characteristic: very wide relative to depth
Basal edge characteristic: straight to slightly convex
Flaking: Secondary flaking is largely bifacial, with expanding and conchoidal scars, often more extensive on one face; two specimens (24LN443-1 and 24LN1058-260) are flaked only along the margins, as they are made from a very platty argillite (mudstone).
Grinding: not readily apparent, except for three specimens (24LN388-6, 24LN1054-268, and 24LN1054-1441) with slight basal grinding
Type of blanks: probably flakes considerably larger than the final product
Similar to: Kutenai Plains Side-Notched or perhaps Salmon River Side-Notched
Time period: late Middle Period

Table D-23. Metric (mm) and Material Type Attributes for Large, Wide Notched Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
388-6	Blk, Opq, Mud	--	23.2	5.5	23.2	-19.0	14.4	7.0	--	6.6
443-1	Grn, Opq, Mud	36.6	18.3	6.1	18.3	17.7	14.9	5.7	27.2	9.4
1054-268	Red, Opq, Cht	32.2	23.6	7.3	23.3	16.1	12.8	7.1	22.0	10.2
1054-288	Blk, Opq, Mud	37.0	17.7	6.5	17.2	15.5	12.2	8.3	26.9	10.1
1054-289	Red, Opq, Qtz	31.6	19.4	6.1	19.4	11.6	11.1	8.5	20.4	11.2
1054-1441	Blk, Opq, Mud	36.7	21.2	5.1	21.2	17.6	15.0	8.5	23.7	13.0
1058-260	Grn, Opq, Mud	--	20.0	3.3	20.0	16.6	12.2	7.0	--	10.0
1074-20	Blk, Opq, Mud	--	16.1	5.1	16.1	14.1	11.9	5.7	--	9.3
Total (8)										
Mean		34.8	19.9	5.6	19.8	16.0	13.1	7.2	24.0	10.0
Std Dev		2.7	2.6	1.2	2.6	2.3	1.5	1.1	3.0	1.8

Table D-24. Metric (mm) and Material Type Attributes for Medium, Stemmed, Concave Base Projectile Points.

Site Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Length	Blade Length	Base Length	Sub-Class
400-4	Blk,Opq,Mud	--	--	--	16.5	12.6	12.3	8.8	--	10.2	a
1073-31	Bwn,Opq,Mud	-31.0	18.7	6.3	18.7	13.3	12.8	11.3	-19.3	11.7	a
1094(H)-I	Gry,Opq,Cht	39.8	17.9	5.0	16.3	-14.0	12.5	12.7	30.7	9.1	a
Sub-total (3)											
Mean		35.4	18.3	5.6	17.2	13.3	12.5	10.9	25.0	10.3	
Std Dev		6.2	0.6	0.9	1.3	0.7	0.2	2.0	8.1	1.3	
189-79/S/1	Blk,Opq,Mud	51.5	21.2	4.5	21.0	14.7	10.3	9.3	41.5	10.0	b
388-210	Blk,Opq,Mud	-30.0	20.0	5.6	20.0	-14.0	11.3	10.3	-29.6	10.4	b
1054-33	Blk,Opq,Mud	31.2	20.5	6.6	20.5	15.0	11.6	8.8	25.5	10.5	b
1073-247	Grn,Opq,Mud	51.5	21.1	6.5	20.3	16.1	12.7	10.1	38.4	13.1	b
Sub-total (4)											
Mean		44.3	20.7	5.5	20.4	14.9	11.5	9.4	33.8	11.0	
Std Dev		12.4	0.5	1.0	0.4	0.9	1.1	1.0	7.5	1.4	
Total (7)											
Mean		39.2	19.9	5.8	19.0	14.2	12.0	10.0	30.8	10.7	
Std Dev		10.2	1.3	0.9	1.9	1.2	0.9	1.6	9.2	1.3	

Medium Stemmed, Concave Base Projectile Points (Figure 8-11, a-f)

Summary Outline (N=7)

Subtype a (N=3), Figure 8-11, d-e

Blade: triangular to excurvate
Cross section: biconvex
Shoulders: distinct, but sloping
Haft element points of juncture: lateral-basal
Haft element characteristic: lateral edges are almost parallel
Basal edge characteristic: concave, almost indented
Flaking: Secondary flake scars are extensive, uniform and bifacial; they are expanding and conchoidal. One specimen (24LN1094(H)-I) exhibits fine trimming along the margins.
Grinding: apparent on lateral and basal edges of the haft element
Type of blank: large flakes or biface preforms
Similar to: Duncan/Hanna Stemmed
Time period: late Middle Period

Subtype b (N=4), Figure 8-11, a-c, f

Blade: triangular to excurvate
Cross section: plano-convex (2); biconvex (2)
Shoulders: distinct, sloping less than subtype a
Haft element points of juncture: lateral-coincidental to lateral-basal
Haft element characteristic: lateral edges expand markedly
Basal edge characteristic: concave
Flaking: Primary flake scars evident on one face; secondary flake scars are uniform and bifacial, and expanding and conchoidal; they tend not to cover the midportion of either face.
Grinding: apparent on lateral and basal edges of haft element
Similar to: Duncan/Hanna Stemmed
Time period: late Middle Period

Large Indented Base Projectile Points (Figure 8-12, k-l)

Summary Outline (N=6)

Blade shape: excurvate; widest part of artifact is between the shoulers and the tip
Cross section: plano-convex (4); biconvex (2)
Haft element points of juncture: basal-basal
Basal edge characteristic: base exhibits a distinct notch (4) or is markedly concave (2); in all cases basal thinning is clearly evident

Table D-25. Metric (mm) and Material Type Variables for Large, Indented Base Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder[1] Width	Base Width	Min.[2] Tang Width	Notch Width	Blade[3] Length	Base[4] Length
712-1	Blk, Opq, Mud	~49.0	25.5	4.9	25.5	21.5	21.5	~10.0	~34.0	15.0
1054-418	Blk, Opq, Mud	43.5	29.9	7.7	29.9	17.6	17.6	12.5	28.3	15.2
1054-1204	Gry, Opq, Mud	--	--	--	--	20.4	20.4	9.5	--	--
1074-32	Wht, Opq, Cht	42.4	24.6	6.3	24.6	17.3	17.3	7.5	24.4	18.0
1086-2	Blk, Opq, Mud	40.3	23.9	5.7	23.9	20.0	20.0	8.7	28.3	12.0
IA-19	Grn, Opq, Mud	~42.0	17.0	--	17.0	14.7	14.7	3.5	~32.5	9.5
Total (6)										
Mean		43.4	24.2	6.2	24.2	18.6	18.6	8.6	29.5	13.9
Std Dev		3.3	4.6	1.2	4.6	2.5	2.5	3.0	3.8	3.3

[1] Same as widest point which is between tip and base.

[2] Same as base width.

[3] From widest point to tip (distal end).

[4] From widest point to base (proximal end).

Flaking: Primary flake scars are evident on the two specimens without a distinct notch; other specimens exhibit uniform, expanding and conchoidal flake scars on both faces. Two specimens (24LN1054-418 and 24LN1086-2) may not be finished artifacts; rather they could be between the preform and finished product stages.
Grinding: not evident
Type of blank: probably flakes considerably larger than final product
Similar to: McKean or Lanceolate, Indented Base types
Time period: late Middle Period

Large, "Eared," Indented Base Projectile Points (Figure 8-13, a-j)

Summary Outline (N=27)

Comments: Two subtypes are defined primarily on the basis of size. Subtype a specimens tend to have wider minimum tang widths, longer and wider blades, bulbous "ears," and the widest measurement tends to be at the base. Subtype b specimens are smaller and at least six of its 13 members have been reworked.

Subtype a (N=14), Figure 8-13, a-e
Blade shape: triangular (7); excurvate (2); lanceolate (2); indeterminate (3)
Cross section: plano-convex (7); biconvex (7)
Shoulders: distant to almost absent
Haft element points of juncture: lateral-lateral (6); lateral-coincidental (4); lateral-basal (2); indeterminate (2)
Notch characteristic: variable, from about as wide as deep to wider than deep
Basal edge characteristic: thinned, with obvious indentation to broadly concave
Flaking: Primary flake scars tend to be evident on at least one face; secondary flake scars are expanding and conchoidal; they are extensive and uniform, but usually cover more of one face than the other.
Grinding: "Ears" and basal edges tend to be ground
Type of blank: probably large flakes, but possibly from bifacial preforms
Similar to: Oxbowl or "Eared," Indented Base
Time period: early Middle Period

Subtype b (N=13), Figure 8-13, f-j
Blade shape: triangular (6); lanceolate to excurvate (6); indeterminate (1)
Cross section: plano-convex (6); biconvex (7)
Shoulders: very distinct to very rounded

Table D-36. Metric (mm) and Material Type Attributes for Large "Eared" Indented Base Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Sub-Class
190-11	Gry,Opq,Mud	--	--	--	--	20.0	15.5	6.0	--	~12.0	a
364-20	Blk,Opq,Mud	~45.0	23.0	6.3	21.2	~23.0	16.4	5.1	~35.5	9.5	a
(365)192-79/S/3	Blk,Opq,Mud	~27.0	20.8	4.5	19.2	20.8	15.8	5.6	~17.8	9.2	a
429-4	Blk,Opq,Mud	--	--	--	--	19.8	17.0	4.3	--	9.9	a
429-5	Blk,Opq,Mud	--	21.4	4.9	21.4	15.7	15.1	6.2	--	6.1	a
682-1	Blk,Opq,Mud	~49.5	17.2	5.1	17.2	18.1	13.1	4.1	~41.7	7.8	a
1054-22	Gry,Opq,Mud	29.3	19.3	3.5	16.8	19.3	16.5	5.5	19.6	9.7	a
1054-32	Blk,Opq,Mud	~40.0	21.7	5.3	21.7	16.7	12.8	5.5	~31.7	8.3	a
1054-388	Blk,Opq,Mud	~50.0	25.3	5.5	25.3	21.7	17.6	5.8	~39.2	10.8	a
1054-430	Blk,Opq,Mud	43.2	24.4	4.6	24.4	23.8	19.1	4.0	33.2	10.0	a
1054-1205	Gry,Opq,Mud	28.2	19.4	6.0	17.1	19.4	15.1	5.3	19.3	8.9	a
1055-10	Blk,Opq,Mud	41.2	20.2	4.6	20.2	19.1	15.7	4.7	31.4	9.8	a
1073-I-79/S/2	Red,Opq,Cht	~35.0	~24.0	4.3	22.6	~24.0	~17.6	3.2	~24.8	10.2	a
1073-II-79/S/2	Blk,Opq,Mud	37.2	21.5	4.7	21.5	20.5	16.3	5.6	27.5	9.7	a
Sub-total (14)											
Mean		38.7	21.5	5.0	20.7	20.1	16.0	5.1	29.2	9.6	
Std Dev		8.1	2.4	0.7	2.8	2.4	1.7	0.8	8.2	1.1	

Table D-36. (Continued)

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Sub-Class
199-79/S/3	Blk,Opq,Mud	26.8	17.4	4.0	14.4	17.4	12.7	4.0	16.0	9.9	b
386-1	Blk,Opq,Mud	24.9	17.8	4.9	17.8	14.4	12.5	6.4	16.5	8.4	b
400-1	Gry,Tns,Cht	18.0	15.1	4.1	14.2	15.1	13.1	[illegible]	11.1	6.9	b
1054-16	Wht,Opq,Cht	--	18.6	4.4	18.6	16.3	12.7	4.0	--	9.4	b
1054-50	Blk,Opq,Mud	~31.0	18.2	4.9	18.2	15.5	13.3	9.9	19.4	11.6	b
1054-266	Blk,Opq,Mud	--	16.8	4.8	16.8	14.3	13.4	[illegible]	--	8.1	b
1054-267	Blk,Opq,Mud	--	--	--	--	13.4	10.0	4.6	--	--	b
1054-290	Gry,Opq,Mud	25.0	16.2	4.9	16.2	13.1	12.4	5.3	17.3	7.7	b
1054-387	Blk,Opq,Mud	22.4	18.5	5.1	18.5	16.7	13.5	5.0	14.5	7.4	b
1059-4	Blk,Opq,Mud	32.2	18.7	4.8	18.7	15.6	12.7	4.9	24.2	8.0	b
1064(78-3-2)	Blk,Opq,Mud	21.0	15.5	4.4	15.5	14.4	11.1	5.0	13.3	8.7	b
1074-31	Blk,Opq,Mud	~36.0	19.3	5.0	19.3	16.6	11.5	5.1	27.2	8.8	b
1086-5	Blk,Opq,Mud	28.4	17.9	4.7	17.9	16.5	13.4	4.9	18.9	9.5	b
Sub-total (13)											
Mean		26.6	17.6	4.7	17.2	15.4	12.5	5.2	17.9	8.7	
Std Dev		5.5	1.4	0.4	1.8	1.3	1.0	1.6	4.5	1.2	
Total (27)											
Mean		32.9	19.5	4.8	19.0	17.8	14.3	5.1	23.8	9.2	
Std Dev		9.2	2.8	0.6	2.9	3.1	2.2	1.3	8.8	[illegible]	

Haft element points of juncture: lateral-coincidental (9); lateral-lateral (2); lateral-basal (1); indeterminate (1)
Notch characteristic: variable, from almost absent to very distinct and about as wide as deep
Basal edge characteristic: thinned with obvious indentation to broadly concave
Flaking: Primary flake scars, if present, are largely obscured; secondary flake scars tend to be expanding and conchoidal in shape; they are extensive, uniform and usually cover about the same proportion of both faces.
Grinding: Bases and "ears" tend to be ground
Type of blank: probably flakes, but possibly from bifacial preforms
Similar to: Oxbow
Time period: early Middle Period

Large Side-Notched Projectile Points (Figure 8-14, f-l)

Summary Outline (N=16)

Comments: Two subtypes are defined primarily on the basis of basal edge configuration, but also because material type is uniformly a black opaque mudstone in subtype a specimens. Material type varies considerably among subtype b specimens.

Subtype a (N=5), Figure 8-14, f-h
Blade shape: triangular
Cross section: plano-convex
Shoulders: very distinct, near right angles to slightly sloping
Haft element points of juncture: lateral-lateral
Notch characteristic: from wide as deep to deeper than wide
Basal edge characteristic: slightly concave in all cases
Flaking: Primary flaking is bifacial, but largely obscured by secondary flake scars which are expanding and conchoidal in shape, but irregular in spacing and size.
Grinding: the basal edge and notches are well to slightly ground
Type of blank: probably flakes considerably larger than the finished product
Similar to: Bitterroot Side-Notched
Time period: early Middle Period

Subtype b (N=11), Figure 8-14, i-l
Blade shape: triangular

Table D-39. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Flake/Chip, Class: Opposing Margins (N=55).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
193-79/S/6	Mudstone	62.65	40.80	16.40	Thick Edge Mod.
193-79/S/7	Mudstone	28.50	22.15	5.60	Thin Edge Mod.
364-2	Mudstone	24.65	18.75	4.60	Thin Edge Mod.
365-6	Chert	11.45	17.15	3.65	Thin Edge Mod.
385-119	Mudstone	38.00	59.70	7.80	Thin Edge Mod.
387-5	Mudstone	18.45	16.45	3.00	Thin Edge Mod.
388-115	Mudstone	28.15	20.75	6.85	Thin Edge Mod.
388-147	Mudstone	33.25	35.55	6.65	Thin Edge Mod.
388-194	Mudstone	24.25	23.25	5.30	Thin Edge Mod.
388-217	Chert	32.90	29.80	3.50	Thin Edge Mod.
416-1	Mudstone	23.90	26.45	6.15	Thin Edge Mod.
422-1	Chert	37.00	19.00	4.15	Thin Edge Mod.
679-1	Mudstone	24.40	32.65	3.75	Thin Edge Mod.
679-2	Chert	23.55	17.05	2.55	Thin Edge Mod.
704-2	Mudstone	35.00	29.90	6.80	Thin Edge Mod.
704-4	Mudstone	30.90	17.10	5.30	Thin Edge Mod.
707-65	Chert	13.75	23.35	4.80	Thin Edge Mod.
1054-1	Mudstone	47.65	25.90	7.25	Thin Edge Mod.
1054-21	Chert	16.10	19.95	7.35	Thin Edge Mod.
1054-23	Mudstone	19.10	21.70	4.00	Thin Edge Mod.
1054-120	Mudstone	28.30	24.10	3.05	Thin Edge Mod.
1054-136	Quartzite	37.65	22.85	7.65	Thin Edge Mod.
1054-231	Mudstone	34.00	19.50	7.85	Thin Edge Mod.
1054-243	Mudstone	35.15	13.20	5.85	Thin Edge Mod.
1054-253	Chert	26.95	17.40	5.05	Thin Edge Mod.
1054-264	Mudstone	36.30	26.30	14.05	Thin Edge Mod.
1054-280	Mudstone	36.25	11.45	4.80	Thin Edge Mod.
1054-291	Mudstone	68.00	44.30	7.30	Thin Edge Mod.
1054-379	Mudstone	26.95	27.45	3.30	Thin Edge Mod.
1054-422	Mudstone	40.90	18.20	7.25	Thin Edge Mod.
1054-1221	Mudstone	24.15	21.70	4.00	Thin Edge Mod.
1054-1224	Mudstone	46.85	24.00	6.20	Thin Edge Mod.
1054-1286	Mudstone	30.35	25.50	9.05	Thin Edge Mod.
1054-1301	Mudstone	26.95	13.20	3.80	Thin Edge Mod.
1054-1306	Mudstone	11.50	18.85	1.65	Thin Edge Mod.
1054-79/S/3	Mudstone	45.50	27.15	6.90	Thin Edge Mod.
1056-2	Mudstone	62.15	36.50	8.30	Thin Edge Mod.
1056-5	Mudstone	49.20	20.00	5.90	Thin Edge Mod.
1058-79/S/1	Mudstone	13.60	13.65	2.35	Thin Edge Mod.
1058-1	Mudstone	76.05	66.60	12.90	Thin Edge Mod.
1058-2	Mudstone	37.35	26.90	6.60	Thin Edge Mod.
1058-259	Mudstone	31.10	14.95	6.75	Thin Edge Mod.
1058-263	Mudstone	51.00	20.55	8.10	Thin Edge Mod.
1059-21	Mudstone	29.55	23.30	5.55	Thin Edge Mod.
1060-14	Mudstone	62.25	39.15	15.50	Thin Edge Mod.
1060-18	Mudstone	50.35	27.50	8.25	Thin Edge Mod.
1060-29	Mudstone	67.65	25.65	6.55	Thin Edge Mod.
1060-40	Mudstone	18.55	24.15	6.15	Thin Edge Mod.
1073-3	Mudstone	35.25	19.45	4.80	Thin Edge Mod.
1073-5 (west)	Mudstone	44.90	29.50	6.60	Thin Edge Mod.
1073-87	Mudstone	25.15	17.55	2.10	Thin Edge Mod.
1073-79/S/9	Mudstone	39.25	21.20	4.90	Thin Edge Mod.
1074-21	Mudstone	41.85	2.15	5.30	Thin Edge Mod.
1074-34	Mudstone	31.40	26.30	8.75	Thin Edge Mod.
IA-25	Mudstone	61.40	43.60	7.50	Thin Edge Mod.

Opposing Margins (N=55)

This class includes flakes with modification (i.e., flaking) along two, opposing edges. Most of the specimens are small but some medium size artifacts are represented (Table D-39). Various mudstones are the most common raw material (N=47), but some artifacts are made from cherts (N=7) and one is quartzite (Table D-39).

Alternate Faces (N=21)

This class is made up of unifacially flaked (along at least two margins or edges) specimens. The flaking occurs on alternate faces. Most of the specimens are made of mudstone (Table D-40).

Unifacial/Bifacial Tabular Pieces (N=18)

Items in this class are virtually identical to those in the LAURD collection are referred to as "Argillite Knives" (Roll and Smith 1982). These artifacts are made on thin tabular pieces of mudstone or argillite (Table D-40). Both whole and fragmentary pieces are included. Edges are flaked to shape the object into an ovoid to rectangular form. Flakes are not "invasive".

Generalized Unifacial (N=327)

The majority (61.4%) of the edge modified flakes have been flaked unifacially along one edge or end (Figure 8-17, d). Most are small, but medium and large size specimens also are represented (Table D-41).

Edge Modified Cobbles

This subcategory includes three classes of artifacts, all of which are made on cobbles or split cobbles, as evidenced by the presence of stream worn cortex. Modifications are confined to the margins.

The first class--Unifacially Trimmed (Figure 8-18, b, d)--includes 24 specimens from ten sites (Table D-42). These artifacts tend to be in the large to medium size ranges and most of them exhibit only slight edge damage that could be construed as use-wear. The second class--Bifacially Trimmed (Figure 8-18, a, c)--includes 11 artifacts from seven sites. These tend to be smaller and have less of their edges modified in comparison to the unifacially trimmed artifacts (Table D-42). The third class--Notched Cobbles (Figure 8-19)--includes 10 artifacts from eight sites. These notched cobbles are similar to artifacts traditionally referred to as "net sinkers" (Table D-42). Similar artifacts in the LAURD collection are termed notched, cobbles, pebbles, and tabular pieces (Roll and Smith 1982).

Table D-38. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Flakes/Chips, Classes: Pointed End (N=37), Notched (N=6), and Bifacial Generalized (N=16).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Pointed End					
193-79/S/5	Mudstone	25.70	16.65	2.20	Thin Edge Mod.
364-14	Mudstone	49.40	41.65	11.25	Thin Edge Mod.
378-2	Mudstone	52.35	37.80	8.50	Thin Edge Mod.
393-2	Mudstone	39.65	29.80	5.60	Thin Edge Mod.
396-5	Mudstone	28.70	21.80	4.15	Thin Edge Mod.
400-1	Mudstone	17.00	23.60	4.95	Thin Edge Mod.
447-6	Chert	14.30	12.60	3.70	Thin Edge Mod.
488-1	Chert	32.95	22.40	3.70	Thin Edge Mod.
666-3	Chert	13.45	9.95	3.30	Thin Edge Mod.
706-8	Chert	26.25	17.35	2.90	Thin Edge Mod.
712-6	Mudstone	41.10	24.45	3.65	Thin Edge Mod.
1054-7	Mudstone	17.75	14.35	2.30	Thin Edge Mod.
1054-71	Mudstone	18.15	27.40	4.85	Thin Edge Mod.
1054-74	Mudstone	28.00	22.15	3.25	Thin Edge Mod.
1054-163	Mudstone	39.55	23.55	5.90	Thin Edge Mod.
1054-237	Mudstone	21.55	17.20	3.05	Thin Edge Mod.
1054-247	Chert	17.00	13.60	2.90	Thin Edge Mod.
1054-310	Mudstone	39.85	30.05	6.35	Thin Edge Mod.
1054-351	Mudstone	32.45	29.20	3.70	Thin Edge Mod.
1054-355	Mudstone	26.90	24.25	3.20	Thin Edge Mod.
1054-385	Mudstone	4.25	29.80	2.90	Thin Edge Mod.
1054-444	Mudstone	26.10	24.15	7.30	Thin Edge Mod.
1054-1206	Chert	11.40	11.15	3.60	Thin Edge Mod.
1054-1269	Quartzite	50.30	35.40	12.65	Thin Edge Mod.
1054-1283	Mudstone	28.65	14.55	2.40	Thin Edge Mod.
1054-1303	Mudstone	8.50	10.65	2.05	Thin Edge Mod.
1054-1311	Mudstone	20.80	7.90	2.15	Thin Edge Mod.
1054-1313	Mudstone	28.40	15.95	2.40	Thin Edge Mod.
1054-1318	Mudstone	28.45	19.90	3.25	Thin Edge Mod.

Table D-38. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Pointed End					
1054-1429	Mudstone	24.55	17.25	2.75	Thin Edge Mod.
1054-1442	Mudstone	8.45	16.30	3.85	Thin Edge Mod.
1059-20	Mudstone	42.25	26.90	7.10	Thin Edge Mod.
1073-79/S/10	Mudstone	40.70	31.40	5.10	Thin Edge Mod.
1074-16	Mudstone	26.45	27.45	8.60	Thin Edge Mod.
1074-33	Mudstone	40.40	21.55	6.35	Thin Edge Mod.
1087-19	Chert	23.25	17.65	4.10	Thin Edge Mod.
IA-24	Quartzite	38.65	41.90	10.80	Thin Edge Mod.
Notched					
1054-325	Mudstone	59.50	46.40	14.00	Thin Edge Mod.
1054-403	Mudstone	61.65	32.20	20.50	Thick Edge Mod.
1054-1218	Chert	24.20	22.05	14.00	Thin Edge Mod.
1054-1375	Mudstone	12.30	13.60	2.60	Thin Edge Mod.
1059-38	Quartzite	29.90	29.15	5.35	Thin Edge Mod.
1073-79/S/34	Quartzite	71.05	68.65	21.30	Thick Edge Mod.
Bifacial					
193-79/S/3	Mudstone	31.50	29.30	9.60	Thin Edge Mod.
366-25	Mudstone	36.55	32.85	9.50	Thin Edge Mod.
383-1	Mudstone	33.05	20.10	5.80	Thin Edge Mod.
388-41	Quartzite	86.85	60.30	31.25	Thick Edge Mod.
388-202	Mudstone	51.70	38.95	14.70	Thin Edge Mod.
421-1	Mudstone	43.45	22.00	9.90	Thin Edge Mod.
679-3	Mudstone	63.20	41.35	8.55	Thin Edge Mod.
1054-53	Mudstone	26.70	23.55	7.50	Thin Edge Mod.
1054-104	Mudstone	54.80	38.50	15.85	Thick Edge Mod.
1054-1267	Quartzite	74.40	43.30	29.00	Thick Edge Mod.
1054-1291	Mudstone	51.15	37.30	8.20	Thin Edge Mod.
1054-1377	Mudstone	30.35	15.25	7.45	Thin Edge Mod.
1073-79/S/13	Chert	21.85	18.05	3.55	Thin Edge Mod.
1073-79/S/23	Mudstone	73.85	33.35	10.30	Thin Edge Mod.
1073-265	Mudstone	71.00	44.10	19.75	Thick Edge Mod.
1076-2	Quartzite	60.60	66.50	17.70	Thick Edge Mod.

Table D-37. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Flakes/Chips, Class: Unifacial Endscraper (N=53).

Site/Cat No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
364-18	Mudstone	26.75	21.15	4.65	Thin Edge Mod.
371-1	Mudstone	62.20	39.80	19.40	Thick Edge Mod.
373-6	Mudstone	35.30	30.75	9.35	Thin Edge Mod.
384-3	Chert	13.70	13.50	3.55	Thin Edge Mod.
385-7	Mudstone	27.00	23.50	7.25	Thin Edge Mod.
385-97	Mudstone	54.74	30.60	15.85	Thick Edge Mod.
386-59	Mudstone	37.25	34.45	5.75	Thin Edge Mod.
387-10	Mudstone	32.20	30.05	7.85	Thin Edge Mod.
389-2	Mudstone	78.15	26.00	9.75	Thin Edge Mod.
487-2	Mudstone	34.35	30.00	7.05	Thin Edge Mod.
656-6	Quartzite	22.15	24.40	7.70	Thin Edge Mod.
706-37	Mudstone	37.75	27.70	11.30	Thin Edge Mod.
707-1	Chert	26.50	15.15	4.50	Thin Edge Mod.
711-2	Chert	15.85	22.65	3.25	Thin Edge Mod.
1054-20	Chert	29.85	24.90	6.75	Thin Edge Mod.
1054-67	Mudstone	28.25	18.15	5.80	Thin Edge Mod.
1054-123	Mudstone	25.65	29.70	7.70	Thin Edge Mod.
1054-147	Mudstone	20.05	14.85	4.40	Thin Edge Mod.
1054-221	Mudstone	20.50	15.95	5.00	Thin Edge Mod.
1054-223	Mudstone	45.95	34.80	10.20	Thin Edge Mod.
1054-342	Mudstone	25.10	20.60	5.20	Thin Edge Mod.
1054-343	Mudstone	21.65	31.40	4.90	Thin Edge Mod.
1054-346	Mudstone	34.15	23.10	6.15	Thin Edge Mod.
1054-389	Mudstone	58.50	31.70	11.55	Thin Edge Mod.
1054-417	Mudstone	17.45	12.50	3.10	Thin Edge Mod.
1054-424	Mudstone	21.65	17.35	4.65	Thin Edge Mod.
1054-428	Mudstone	34.15	22.85	9.50	Thin Edge Mod.
1054-441	Mudstone	27.70	20.05	5.85	Thin Edge Mod.
1054-1201	Mudstone	23.10	18.50	4.70	Thin Edge Mod.
1054-1212	Mudstone	27.30	22.25	7.35	Thin Edge Mod.

Table D-37. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1314	Mudstone	30.10	27.00	8.55	Thin Edge Mod.
1054-1404	Mudstone	16.95	24.15	5.25	Thin Edge Mod.
1054-1415	Mudstone	26.80	17.30	5.40	Thin Edge Mod.
1054-1417	Mudstone	40.40	27.60	9.05	Thin Edge Mod.
1055-27	Mudstone	11.00	14.40	4.10	Thin Edge Mod.
1056-1	Mudstone	26.80	22.15	5.05	Thin Edge Mod.
1058-6	Quartzite	17.40	24.05	6.55	Thin Edge Mod.
1058-16	Mudstone	13.70	21.25	4.15	Thin Edge Mod.
1060-6	Mudstone	33.15	25.60	10.00	Thin Edge Mod.
1060-7	Mudstone	39.55	24.70	7.30	Thin Edge Mod.
1060-13	Mudstone	49.15	17.55	6.55	Thin Edge Mod.
1060-28	Mudstone	46.75	25.10	6.00	Thin Edge Mod.
1073-5	Mudstone	26.50	19.50	4.00	Thin Edge Mod.
1073-19	Mudstone	26.35	35.55	8.10	Thin Edge Mod.
1073-79/S/20	Mudstone	29.85	28.75	7.30	Thin Edge Mod.
1073-79/S/24	Mudstone	57.80	32.60	8.00	Thin Edge Mod.
1073-79/S/41	Mudstone	57.60	37.90	8.55	Thin Edge Mod.
1073-79/S/42	Mudstone	29.25	25.25	8.60	Thin Edge Mod.
1073-79/S/43	Mudstone	32.00	22.25	8.35	Thin Edge Mod.
1074-15	Mudstone	16.90	16.95	3.65	Thin Edge Mod.
1081-1	Mudstone	36.55	39.75	10.45	Thin Edge Mod.
1097-2	Mudstone	24.40	19.50	7.60	Thin Edge Mod.
IA-18	Chert	21.90	23.00	8.40	Thin Edge Mod.

Unifacial "End-Scrapers" (N=53)

Specimens in this class (Figure 8-17, a) are equivalent to those in the LAURD collection also termed end-scrapers (Roll and Smith 1982). Pressure flaking is evident on the bit end and along the sides. Several specimens are made on complete biface thinning flakes but most are made on broken flakes. The edge angle of "end-scrapers" tends to be fairly regular; based on visual inspection angles appear to be between 30° and 45°. Sizes vary considerably in this class, but most artifacts are small. Mudstones are the most common raw material type; cherts are well represented, and only two artifacts are made from quartzite (Table D-37). Only one mudstone specimen (24LN1054-346) appears to have been heat treated, but two of the chert specimens are burned and exhibit potlids. The smaller specimens characteristically have a well worn and rounded distal edge. The larger ones tend to have rough edges and appear to have been used on harder materials or for heavy-duty tasks.

Unifacial, Pointed Tips (N=37)

Edge modified flakes in the unifacial, pointed tip class (Figure 8-17, b) are somwwhat like some of those termed gravers in the LAURD collection (Roll and Smith 1982). Most (27) are made from various mudstones; seven are chert, and two are quartzite (Table D-38). All are made on relatively thin, small flakes. Two are made on bifacial thinning flakes. The points do not appear to be particularly sharp, as would be expected for a piercing tool, nor are they wedge shaped in cross section as would be expected for an engraving tool. Most have two adjoining flaked margins which meet in a point, but some have one flaked margin that joins a sharp, broken edge. None appear to have been heat treated.

Unifacial, Notched (N=6)

All but one of the unifacial and notched, edged modified flakes (Figure 8-17, c) are made from mudstone materials, and size varies considerably (Table D-38). Most of the notches are rather small and fail to exhibit readily detectable edge damage. Notched artifacts similar to these have traditionally been termed "spoke shaves." Similar items in the LAURD collection are called notched flakes (Roll and Smith 1982).

Generalized Bifacial (N=16)

This class (Figure 8-17, e) consists of those specimens that have bifacial flaking along one or more margins. Mudstone is the most common material type (Table D-38).

Table D-34. Metric (mm) and Material Type Attributes for Morpho/Techno Class Haft Biface Undetermined (N=5).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
656-5	Mudstone	20.00	12.90	4.40	Thin Biface
666-1	Mudstone	15.70	12.90	3.40	Thin Biface
1073-79/S/26	Mudstone	24.30	16.40	3.70	Thin Biface
1073-179	Mudstone	19.10	12.80	3.10	Thin Biface
1087- (USCE 78-6-3)	Chert	24.00	15.30	4.70	Thin Biface

Table D-35. Metric (mm) and Material Type Attributes for Morpho/Techno Class Haft Biface Undetermined with Part of Haft Element (N=2).

Site/Cat. No. (24LN....-...)	Material Type	Width (mm)	Thickness (mm)	Shoulder Width	Min. Tang Width	Blade Length
487-1	Mudstone	16.00	5.00	16.00	8.80	24.00
1074-26	Mudstone	15.00	4.90	15.00	10.00	20.00

Table D-36. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Unifaces, Classes: Endscraper (N=10), Large (N=12), and Fragment (N=2).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
End Scraper					
364-8	Other	24.40	14.40	6.10	Thin Edge Mod.
388-21	Mudstone	48.20	44.65	15.30	Thick Edge Mod.
420-1	Chert	33.30	20.90	7.25	Thin Edge Mod.
1054-241	Quartzite	51.20	32.65	20.00	Thick Edge Mod.
1054-263	Mudstone	22.10	18.60	5.20	Thin Edge Mod.
1054-265	Chert	25.65	19.10	9.45	Thin Edge Mod.
1054-395	Chert	23.50	24.05	6.30	Thin Edge Mod.
1073-13	Mudstone	40.25	21.70	9.50	Thin Edge Mod.
1073-79/S/48	Quartzite	41.25	23.40	7.60	Thin Edge Mod.
1076-1	Mudstone	52.90	43.55	23.30	Thick Edge Mod.
Large					
675-1	Mudstone	47.30	35.45	20.40	Thick Edge Mod.
1054-228	Mudstone	79.60	67.25	17.50	Thick Edge Mod.
1054-284	Mudstone	57.45	31.45	9.05	Thin Edge Mod.
1054-1242	Quartzite	70.35	36.10	15.70	Thick Edge Mod.
1054-1317	Quartzite	59.45	35.20	13.00	Thin Edge Mod.
1058-12	Mudstone	49.15	33.60	11.40	Thin Edge Mod.
1059-8	Mudstone	77.90	45.75	18.90	Thick Edge Mod.
1059-29	Mudstone	69.20	67.35	20.85	Thick Edge Mod.
1073-79/S/31	Mudstone	48.60	44.40	25.20	Thick Edge Mod.
1073-34	Mudstone	49.35	30.85	13.35	Thin Edge Mod.
1076-7	Mudstone	54.80	38.50	21.95	Thick Edge Mod.
1086-7	Chert	15.65	17.10	4.65	Thin Edge Mod.
Fragment					
1073-79/S/25	Mudstone	27.85	39.40	5.50	Thin Edge Mod.
1073-263	Mudstone	37.65	41.25	15.50	Thick Edge Mod.

Undetermined Haft Bifaces

The seven fragments in this class are symmetrical bifaces that have either pointed ends or obvious hafting modifications. Their morphology and metric attributes are borderline between the arrow and dart size categories. As such they are not assigned to either category. Subclasses are defined on the basis of the type of fragment. Subclass a includes two blade fragments with part of the haft element retained (Table D-35). Subclass b includes five symmetrical and pointed end blade fragments that lack any vestige of a haft element (Table D-34), but their morphological and technological attributes are indicative of projectile points.

Other Flaked Lithic Products (Miranda Warburton)

Unifaces (Figure 8-16)

Unifaces are defined by "invasive" flakes covering at least 50 percent of one face. The other face is unmodified. Only 24 artifacts are classed as unifaces and two of these are fragments (Table D-36). All are markedly plano-convex in cross section. These artifacts are like those termed scrapers in the LAURD collection (Roll and Smith 1982).

The large, fine grain mudstone artifacts exhibit only percussion flake scars. Six black, very fine grain mudstone, medium to large size unifaces also fail to exhibit evidence of pressure flaking. One of them (24LN1076-7) may be heat treated. The small, end-scrapers unifaces, tend to be pressure flaked along the distal end and several are well worn from use. Three of the small unifaces are made from chert-like material and the others are either mudstone or quartzite. The larger specimens tend to exhibit numerous small step fractures along the distal edge, suggesting use as a heavy-duty scrapping tool or perhaps as a chopping tool. Their large size and steep edge angles suggest use in wood working.

Edge Modified Flakes

These artifacts tend to be made on flakes removed from cores or bifaces. Patterns indicating what types of flakes were seleted for modification are not readily apparent. The edges and/or ends of these artifacts appear to be modified primarily by pressure flaking, but some percussion flaking also is evident. In general, a series of 10-20 short, "noninvasive" flakes are removed from an edge/end to create a sharp working edge. Edge modified flakes are subdivided on the basis of morphological criteria to form a number of classes. Most of these are equivalent to one or more of the "scrapers on flakes" category in the LAURD collection (Roll and Smith 1982).

Table D-33. Metric (mm) and Material Type Attributes for Morpho/Techno Class Other Haft Bifaces, Subclasses: Very Large Notched (N=5), Large Contracting Stem (N=3), and Single Side-Notch (N=4).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Very Large Notched					
375-1	Mudstone	--	36.60	7.20	Thin Biface
394-1	Mudstone	67.10	31.60	7.20	Thin Biface
1054-392	Mudstone	--	47.70	8.30	Thin Biface
1059-3	Mudstone	--	36.10	9.90	Thin Biface
IA-43	Chert	54.40	29.90	7.20	Thin Biface
Large Contracting Stem					
423-69	Mudstone	54.30	28.20	7.20	Thin Biface
1054-10	Mudstone	50.00	23.20	7.20	Thin Biface
1059-15	Mudstone	59.00	25.60	7.90	Thin Biface
Single Side-Notch					
417-3	Chert	22.20	15.00	3.30	Thin Biface
1054-60	Chert	32.70	14.40	4.40	Thin Biface
1054-419	Quartzite	26.10	18.70	6.10	Thin Biface
1054-432	Mudstone	30.00	14.40	5.00	Thin Biface

Subtype c (N=27)

Comments: These are symmetrical, pointed blade fragments assumed to have had haft elements when complete. These fragments are more like the blade portion of projectile points than thye are like any other artifact class.

Other Bifaces with Hafting Modifications

This class includes 12 artifacts from seven sites and is divided into three subclasses of bifaces with hafting modifications. These bifaces are not considered as projectile points for several reasons, including their very large size, morphological characteristics not traditionally associated with projectile points, and/or their assymetrical haft elements.

The first subclass--Very Large, Notched Bifaces (Figure 8-15, d-h)--includes five specimens from five different sites (Table D-33). Their bifacial character and thinness of the blades suggests they were used as knives. Each one is unique in its haft element characteristics. They are briefly described below:

Specimen 24LN375-1: wide side notches and a deeply concave base (Figure 8-15, f);

Specimen 24LN394-1: comparatively narrow side notches and a wide concave base (Figure 8-15, e);

Specimen 24LN1054-392: narrow side-notches, but its basal edge is markedly convex (Figure 8-15, g);

Specimen 24LN1059-3: comparatively narrow, expanding haft element (Figure 8-15, h), and;

Specimen IA-43: corner-notched with a wide tang width (Figure 8-15, d).

The second class--Large Contracting Stem Bifaces (Figure 8-15, a-c)--includes three specimens from three different sites (Table D-33). Blade edges are beveled alternately. Maximum widths are at the shoulders. Blade shapes are triangular and basal edges are straight to slightly convex. The beveled edges suggest these artifacts may have functioned as scraping and perhaps cutting tools.

The third class--Single Side-Notched Bifaces (Figure 8-15, i-j)--includes four triangular shaped specimens from two sites (Table D-33). All four have one shallow side-notch. One specimen (24LN1054-432) has the appearance of two side notches but one side-notch appears to be a fortituous break. Three have straight bases; one has a concave base. These artifacts may be unfinished dart and arrow size projectile points or they may be completed tools that served as knives or perhaps "crude" projectile points.

Table D-31. Metric (mm) and Material Type Attributes for Haft Element Fragments of Dart Size Projectile Points, Subtype b.

Site/Catalog No. (24LN -)	Material Type	Base Width	Min. Tang Width	Thickness of Fragment
388-5	Gry, Opq, Cht	14.35	13.31	3.65
388-7	Grn, Opq, Mud	16.93	14.32	3.19
394-50	Grn, Opq, Mud	--	--	4.65
400-2	Blk, Opq, Mud	--	--	3.80
1054-13	Blk, Opq, Mud	14.60	12.35	5.44
1054-64	Red, Opq, Cht	18.45	13.17	7.83
1054-1209	Bwn, Opq, Cht	19.12	--	3.99
1054-1211	Red, Opq, Cht	--	--	4.20
1054-1260	Blk, Opq, Mud	16.76	14.25	4.65
1054-1276	Gry, Opq, Mud	14.42	13.45	4.82
1054-1309	Gry, Opq, Cht	--	--	3.42
1074-I-79/S/7	Gry, Opq, Cht	19.82	16.19	5.14
1087-5	Blk, Opq, Mud	20.30	15.07	2.75
1097-1	Red, Opq, Qtz	--	--	3.40
Total (14)				
Mean		17.19	14.01	4.35
Std Dev		2.36	1.21	1.27

Table D-32. Metric (mm) and Material Type Attributes for Probable Dart Point Size Projectile Point Blade Fragments, Subtype C.

Site/Catalog No. (24LN -)	Material	Length of Fragment	Width of Fragment	Thickness of Fragment
189-79/S/5)	Bwn, Opq, Cht	15.96	15.09	4.84
190-32	Gry, Opq, Mud	18.21	17.46	4.36
366-21	Wht, Tns, Cht	17.40	17.87	5.00
376-1	Grn, Opq, Mud	38.59	31.32	9.05
385-5	Blk, Opq, Mud	17.09	16.55	3.73
387-9	Blk, Opq, Mud	22.48	19.90	5.70
388-8	Red, Opq, Cht	35.60	21.50	3.91
396-2	Gry, Opq, Mud	15.59	17.85	2.80
399-3	Bwn, Opq, Cht	29.69	20.54	4.63
429-1	Blk, Opq, Mud	11.94	7.75	2.91
677-	Bwn, Opq, Cht	40.85	20.86	5.38
706-6	Blk, Opq, Mud	19.84	20.44	4.64
711-4	Bwn, Opq, Mud	19.42	16.61	4.19
1054-277	Blk, Opq, Mud	27.94	20.30	6.83
1054-372	Blk, Opq, Mud	14.14	17.12	2.45
1054-394	Gry, Opq, Cht	27.53	21.19	4.30
1054-1198	Gry, Opq, Mud	38.16	26.90	5.14
1054-1207	Red, Opq, Qtz	12.56	16.28	3.80
1054-1213	Red, Opq, Cht	20.80	22.31	7.54
1054-1292	Blk, Opq, Mud	11.56	15.00	3.54
1058-252	Gry, Opq, Mud	24.40	22.95	6.81
1060-10	Gry, Opq, Qtz	23.10	19.75	4.75
1060-38	Gry, Opq, Mud	33.44	19.62	6.52
1073-43	Gry, Opq, Mud	25.40	17.89	3.44
1073-251	Blk, Opq, Mud	36.62	26.23	6.26
1074-30	Gry, Opq, Cht	24.11	18.28	3.95
1087-1	Gry, Opq, Cht	11.28	12.36	3.85
Total (27)				
Mean		23.47	18.62	4.83
Std Dev		9.07	5.53	1.54

Table D-29. Metric (mm) and Material Type Attributes for Large Lanceolate Shaped Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width[1]	Base Width	Min. Tang Width[2]	Notch Width	Blade Length[3]	Base Length[4]
364-1	Wht, Opq, Cht	--	18.2	4.7	18.2	~15.5	~15.5	--	--	--
369-4	Bwn, Opq, Cht	--	22.8	6.4	22.8	--	--	--	~42.0	--
394-2	Blk, Opq, Cht	--	21.6	6.6	21.6	16.7	16.7	--	--	15.9
682-2	Blk, Opq, Mud	~65.0	24.5	6.7	24.5	~15.0	~15.0	--	45.0	~20.0
1054-293	Blk, Opq, Mud	~58.0	21.4	5.7	21.4	12.9	12.9	--	~37.5	20.5
1054-1199	Blk, Opq, Mud	--	--	~7.0	--	~14.0	~14.0	--	--	--
1054-1409	Blk, Opq, Mud	--	--	5.5	--	14.4	14.4	--	--	~20.0
1073-I/79/S/1	Red, Opq, Cht	--	--	6.1	--	--	--	--	--	--
IA-44	Gry, Opq, Cht	~51.0	21.0	7.1	21.0	~15.5	~15.5	--	~31.0	~20.0
Total (9)										
Mean		58.0	21.6	6.2	21.6	14.9	14.9	--	38.9	19.3
Std Dev		7.0	2.1	0.8	2.1	1.2	1.2	--	6.1	1.9

[1] Shoulder width, same as maximum width.

[2] Minimum tang width, same as base width or near to it.

[3] Blade length, unground part of longitudinal length.

[4] Base length, ground part of longitudinal length.

Table D-30. Metric (mm) and Material Type Attributes for Dart Size Projectile Points with a Partial Haft Element, Subtype a.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
706-3	Blk, Opq, Mud	--	--	5.1	17.0	--	12.0	--	~15.0	--
1054-343	Gry, Opq, Cht	--	--	4.7	13.5	--	~14.0	--	28.3	--

Large, Lanceolate Shaped Projectile Points (Figure 8-14, a-e)

Summary Outline (N=9)

Comments: This class includes a variety of styles traditionally considered characteristic of the Early Period. All are surface finds and all but one (specimen IA-14) were associated spatially with projectile point styles considered to represent later time periods. All specimens are fragmentary.
Blade shape: lanceolate
Cross section: biconvex (7); plano-convex (2)
Shoulders: very slight to nonexistent
Haft element points of juncture: lateral-coincidental and lateral-axial
Haft element characteristic: lateral edges tend to be parallel to constricting and the haft element is distinguished primarily by grinding of its lateral edges
Basal edge characteristic: straight to concave and one rounded
Flaking: Secondary flake scars are extensive, bifacial and uniform in size; they are expanding and lamellar in shape.
Grinding: lateral and basal edges of the haft element are well ground
Type of blank: flake in two cases, but others may be made from bifacial preforms
Similar to: various types--Lusk Lanceolate, Agate Basin, Lerma, Lovell Constricted, and perhaps Cascade
Time period: late Early Period

Dart Point Fragments

Summary Outline (N=43)

Comments: These specimens are too incomplete for classification, but are most likely fragments of dart size projectile points. They are considered to be generalized markers for periods prior to the Late Prehistoric. This subclass is divided on the basis of the type of fragment.

Subtype a (N=2)
Comments: Part of haft element is present, but the majority is missing, thus precluding classification.

Subtype b (N=14)
Comments: The haft element fragment is complete enough to indicated that the specimen is notched b' ɔo incomplete for reliable classification.
Basal edge characteristic: slightly concave to slightly convex

Cross section: plano-convex (5); biconvex (1); biplano (1); undetermined (4)
Shoulders: very distinct, near right angles to sloping
Haft element points of juncture: lateral-lateral (7); lateral-coincidental (4)
Notch characteristic: tend to be wider than deep
Basal edge characteristic: straight to slightly convex
Flaking: Primary flaking, if present, is obscured largely by extensive, relatively small bifacial secondary flake scars which are expanding and conchoidal in shape.
Grinding: grinding of basal edge evident on all but two specimens; grinding inside the notch evident on six specimens; two lack obvious grinding of any part of the haft element
Type of blank: probably flakes considerably larger than the finished product
Similar to: Bitterroot Side-Notched or perhaps Salmon River Side-Notched
Time period: early Middle Period

Large Stemmed Concave Base Projectile Points (Figure 8-13, k-o)

Summary Outline (N=6)

Blade shape: triangular (4); excurvate (1); unknown (1)
Cross section: biconvex (5); plano-convex (1)
Shoulders: distinct to well rounded
Haft element points of juncture: lateral-coincidental to lateral-basal
Haft element characteristic: lateral edges of haft element are parallel to slightly constricting
Basal edge characteristic: concave, some are almost straight, most have been thinned
Flaking: Secondary flake scars are characteristically expanding and conchoidal; they tend to be extensive, but vary in size.
Grinding: three are slightly ground on the lateral and basal edges of the haft element
Similar to: Stemmed Indented Base and possibly Windust or Pryor Stemmed
Time period: Early Period

Table D-27. Metric (mm) and Material Type Attributes for Large, Side-Notched Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length	Sub-Class
388-4	Blk,Opq,Mud	~32.0	18.1	4.9	17.2	18.1	10.0	5.0	~22.0	10.0	a
712-2	Blk,Opq,Mud	46.1	20.1	4.5	20.1	19.7	13.1	5.3	35.6	10.5	a
1054-29	Blk,Opq,Mud	32.9	21.8	7.0	21.0	21.8	12.5	5.8	21.5	11.4	a
1054-61	Blk,Opq,Mud	~27.0	17.9	4.3	17.6	17.9	11.8	4.8	~17.4	9.6	a
1055-1	Blk,Opq,Mud	26.4	18.7	4.4	18.7	18.2	11.9	4.3	17.3	9.1	a
Sub-total (5)											
Mean		32.9	19.3	5.0	18.9	19.1	11.9	5.0	22.8	10.1	
Std Dev		7.9	1.6	1.1	1.6	1.6	1.2	0.6	7.5	0.9	
386-2	Bwn.Opq,Mud	--	22.7	5.0	22.7	20.5	12.7	4.4	--	8.5	b
388-9	Wht,Opq,Cht	--	--	--	--	16.6	10.1	~7.2	--	10.1	b
1054-429	Bwn,Opq,Mud	~34.0	19.9	5.5	19.4	19.9	12.2	5.0	~24.5	9.5	b
1054-435	Red,Opq,Cht	26.7	19.8	6.4	18.9	19.8	13.8	6.7	15.4	11.3	b
1054-1200	Wht,Opq,Cht	--	--	--	--	19.5	9.8	--	--	--	b
1054-1202	Wht,Opq,Cht	26.5	19.3	5.1	16.3	19.3	10.1	5.6	16.1	10.4	b
1058-15	Bwn,Opq,Qtz	~33.0	18.2	5.5	18.2	16.7	12.8	5.5	~26.8	9.2	b
1059-40	Gry,Opq,Mud	--	~17.5	3.8	~17.5	15.5	10.9	6.6	--	9.4	b
1066-1	Gry,Opq,Cht	~29.0	21.0	6.2	21.0	20.2	13.8	6.6	~19.5	9.5	b
1073-I-79/S/5	Blk,Opq,Mud	30.1	19.7	5.2	19.7	18.7	14.3	6.8	20.1	10.0	b
1073-I-79/S/50	Blk,Opq,Mud	26.0	17.8	5.3	17.8	16.3	11.9	3.9	17.8	9.2	b
Sub-total (11)											
Mean		29.3	19.5	5.3	19.0	18.4	12.0	5.83	20.0	9.6	
Std Dev		3.2	1.6	0.7	1.9	1.8	1.6	1.1	4.2	0.9	
Total (16)											
Mean		30.3	19.5	5.2	19.0	18.7	12.0	5.6	21.2	9.8	
Std Dev		5.6	1.6	0.9	1.8	1.7	1.4	1.0	5.7	0.9	

Table D-28. Metric (mm) and Material Type Attributes for Large Stemmed Concave Base Projectile Points.

Site/Catalog No. (24LN -)	Material Type	Max. Length	Max. Width	Max. Thick-ness	Shoulder Width	Base Width	Min. Tang Width	Notch Width	Blade Length	Base Length
382-1	Red. Opq, Cht	44.6	21.4	7.2	19.2	13.6	14.1	10.5	33.4	11.2
636-7	Red, Opq, Qtz	--	--	7.0	21.1	13.7	15.8	15.6	--	15.4
1054-25	Wht, Opq, Cht	--	--	--	--	15.8	15.7	~17.5	--	~16.9
1054-239	Blk, Opq, Qtz	40.6	21.3	6.2	21.3	15.3	14.1	13.5	24.6	16.0
1054-1197	Bwn, Opq, Qtz	~43.0	25.3	6.1	25.3	14.0	13.0	11.5	~30.6	12.4
1060-9	Blk, Opq, Mud	~35.0	20.2	6.6	20.2	16.4	15.6	10.5	~22.6	12.2
Total (6)										
Mean		40.8	22.0	6.6	21.4	14.8	14.7	13.2	27.8	14.0
Std Dev		4.2	2.2	0.5	2.3	1.2	1.2	2.9	5.0	2.4

Table D-40. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Flakes/Chips, Classes: Alternate Faces (N=21) and Tabular Pieces (N=18).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Alternate Faces					
191-79/S/2	Mudstone	37.05	28.20	8.60	Thin Edge Mod.
365-24	Mudstone	21.85	14.05	3.35	Thin Edge Mod.
388-100	Mudstone	28.15	25.55	5.35	Thin Edge Mod.
443-5	Mudstone	42.60	20.00	6.30	Thin Edge Mod.
656-118	Mudstone	22.80	21.75	2.75	Thin Edge Mod.
1054-91	Mudstone	17.40	18.90	3.75	Thin Edge Mod.
1054-94	Mudstone	28.70	37.95	9.55	Thin Edge Mod.
1054-112	Mudstone	38.00	20.90	4.35	Thin Edge Mod.
1054-115	Mudstone	36.95	22.45	6.40	Thin Edge Mod.
1054-353	Mudstone	46.20	17.55	4.45	Thin Edge Mod.
1054-386	Mudstone	31.00	18.70	4.00	Thin Edge Mod.
1054-1315	Mudstone	29.25	17.85	2.90	Thin Edge Mod.
1054-1445	Mudstone	28.80	17.75	7.80	Thin Edge Mod.
1055-28	Quartzite	35.30	37.65	9.05	Thin Edge Mod.
1058-18	Mudstone	42.60	35.65	7.15	Thin Edge Mod.
1060-30	Chert	26.45	23.50	3.90	Thin Edge Mod.
1073-4	Mudstone	19.60	23.80	4.10	Thin Edge Mod.
1073-36	Mudstone	20.75	17.40	5.40	Thin Edge Mod.
1074-14	Mudstone	56.00	23.35	5.15	Thin Edge Mod.
1087-2	Mudstone	43.25	48.25	15.45	Thick Edge Mod.
IA-26	Mudstone	54.25	23.10	5.75	Thin Edge Mod.
Tabular Pieces					
366-6	Mudstone	108.95	68.25	12.95	Thin Edge Mod.
366-26	Mudstone	90.75	65.50	12.60	Thin Edge Mod.
385-125a	Mudstone	320.00	127.20	18.00	Thick Edge Mod.
385-125b (Fits with a)	(Mudstone)	(64.20)	(117.05)	(14.70)	(Thick Edge Mod.)
387-11	Mudstone	38.90	35.55	5.60	Thin Edge Mod.
423-62	Mudstone	58.55	44.50	6.65	Thin Edge Mod.
425-1	Mudstone	61.00	59.90	5.60	Thin Edge Mod.

Table D-40. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Tabular Pieces					
661-7	Mudstone	128.40	53.95	12.20	Thin Edge Mod.
661-8	Mudstone	110.30	53.55	12.40	Thin Edge Mod.
712-7	Mudstone	78.15	43.20	14.30	Thin Edge Mod.
715-2	Mudstone	68.05	40.05	5.00	Thin Edge Mod.
1064-1	Mudstone	108.90	80.85	19.90	Thick Edge Mod.
1064-3	Mudstone	67.70	51.25	10.00	Thin Edge Mod.
1087-3	Mudstone	56.90	23.10	5.45	Thin Edge Mod.
1087-6	Mudstone	42.60	35.70	7.00	Thin Edge Mod.
1087-13	Mudstone	41.30	22.30	3.50	Thin Edge Mod.
1087-14	Mudstone	58.55	43.55	4.05	Thin Edge Mod.
1087-15	Mudstone	48.75	42.30	5.70	Thin Edge Mod.
1087-16	Mudstone	56.15	43.60	5.20	Thin Edge Mod.

Table D-41. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Flakes/Chips, Class: Unifacial Generalized (N=327).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
193-2	Mudstone	39.40	24.00	7.40	Thin Edge Mod.
193-79/S/10	Mudstone	39.45	60.40	14.00	Thin Edge Mod.
364-4	Mudstone	18.25	26.15	7.00	Thin Edge Mod.
364-6	Quartzite	41.20	46.45	9.75	Thin Edge Mod.
364-9	Mudstone	21.80	19.40	3.55	Thin Edge Mod.
364-10	Quartzite	40.55	37.50	8.10	Thin Edge Mod.
364-15	Mudstone	60.60	49.70	10.90	Thin Edge Mod.
364-22	Mudstone	46.15	46.00	12.75	Thin Edge Mod.
365-1	Quartzite	20.50	28.25	7.70	Thin Edge Mod.
365-23	Mudstone	47.20	25.55	8.90	Thin Edge Mod.
366-3	Mudstone	30.90	27.35	3.75	Thin Edge Mod.
366-7	Mudstone	88.10	55.65	15.20	Thick Edge Mod.
366-8	Mudstone	72.60	43.40	14.65	Thin Edge Mod.
366-11	Chert	51.50	50.65	8.25	Thin Edge Mod.
366-13	Chert	24.80	12.30	6.40	Thin Edge Mod.
366-14	Mudstone	37.60	16.00	8.15	Thin Edge Mod.
366-15	Chert	30.75	23.25	5.35	Thin Edge Mod.
369-9	Mudstone	24.55	23.10	6.55	Thin Edge Mod.
373-1	Mudstone	28.30	27.95	10.20	Thin Edge Mod.
373-2	Mudstone	52.30	34.55	17.45	Thick Edge Mod.
375-7	Mudstone	35.20	36.00	10.90	Thin Edge Mod.
378-1	Mudstone	20.65	22.10	11.20	Thin Edge Mod.
385-113	Mudstone	37.25	26.20	8.70	Thin Edge Mod.
385-120	Mudstone	39.85	25.15	8.60	Thin Edge Mod.
385-128	Chert	30.35	26.40	8.10	Thin Edge Mod.
387-1	Mudstone	66.60	38.80	8.90	Thin Edge Mod.
387-3	Mudstone	34.90	34.10	9.05	Thin Edge Mod.
387-4	Chert	23.25	17.70	7.70	Thin Edge Mod.
387-15	Quartzite	48.35	37.50	9.40	Thin Edge Mod.
387-24	Mudstone	37.95	30.10	11.10	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
387-25	Mudstone	47.75	40.65	13.50	Thin Edge Mod.
387-30	Quartzite	85.90	46.95	40.15	Thick Edge Mod.
388-14	Mudstone	24.80	39.85	8.35	Thin Edge Mod.
388-16	Quartzite	46.00	34.20	10.65	Thin Edge Mod.
388-39	Quartzite	80.25	65.00	27.60	Thick Edge Mod.
388-117	Chert	16.20	16.10	3.10	Thin Edge Mod.
388-124	Mudstone	61.85	22.20	29.10	Thick Edge Mod.
388-158	Mudstone	53.50	34.65	6.75	Thin Edge Mod.
388-163	Mudstone	29.90	34.20	5.95	Thin Edge Mod.
388-196	Mudstone	55.45	83.15	10.30	Thin Edge Mod.
392-1	Mudstone	36.30	61.55	10.80	Thin Edge Mod.
392-8	Mudstone	91.75	45.55	24.00	Thick Edge Mod.
392-9	Mudstone	13.85	20.05	6.35	Thin Edge Mod.
392-10	Mudstone	24.55	14.75	3.65	Thin Edge Mod.
392-12	Mudstone	26.50	33.50	7.00	Thin Edge Mod.
394-16	Mudstone	39.75	27.60	10.55	Thin Edge Mod.
395-1	Mudstone	107.90	69.15	30.05	Thick Edge Mod.
402-1	Chert	36.60	23.10	4.65	Thin Edge Mod.
402-3	Mudstone	21.50	23.70	9.75	Thin Edge Mod.
417-52	Chert	16.50	9.50	2.75	Thin Edge Mod.
429-3	Chert	23.45	22.50	9.15	Thin Edge Mod.
443-6	Mudstone	35.70	33.40	6.70	Thin Edge Mod.
443-9	Mudstone	15.10	15.65	4.75	Thin Edge Mod.
447-2	Mudstone	33.30	20.50	1.35	Thin Edge Mod.
488-2	Mudstone	11.50	15.95	1.55	Thin Edge Mod.
488-3	Mudstone	22.00	23.30	5.00	Thin Edge Mod.
656-1	Mudstone	65.30	57.55	13.50	Thin Edge Mod.
656-3	Mudstone	69.20	42.40	15.65	Thick Edge Mod.
656-11	Mudstone	54.80	28.35	6.30	Thin Edge Mod.
656-143	Mudstone	54.10	24.25	5.05	Thin Edge Mod.
666-1	Mudstone	66.50	33.20	10.45	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
673-1	Mudstone	72.45	58.75	9.60	Thin Edge Mod.
675-2	Quartzite	51.35	50.40	19.95	Thick Edge Mod.
677-2	Mudstone	21.00	19.45	4.85	Thin Edge Mod.
677-3	Mudstone	17.00	20.40	3.45	Thin Edge Mod.
677-4	Mudstone	27.75	25.85	5.40	Thin Edge Mod.
686-4	Mudstone	68.35	57.85	19.15	Thick Edge Mod.
704-3	Mudstone	57.30	35.90	6.90	Thin Edge Mod.
704-11	Chert	31.80	20.10	3.40	Thin Edge Mod.
707-2	Mudstone	21.30	14.85	7.25	Thin Edge Mod.
711-3	Mudstone	42.40	30.20	4.95	Thin Edge Mod.
711-26	Mudstone	64.75	43.25	10.30	Thin Edge Mod.
712-3	Quartzite	24.10	23.95	5.80	Thin Edge Mod.
712-4	Mudstone	62.60	25.45	9.35	Thin Edge Mod.
1054-79/S/1	Quartzite	38.60	21.35	7.65	Thin Edge Mod.
1054-79/S/5	Quartzite	55.90	46.65	15.05	Thick Edge Mod.
1054-5	Quartzite	43.30	32.00	12.05	Thin Edge Mod.
1054-11	Mudstone	42.50	30.00	14.70	Thin Edge Mod.
1054-14	Quartzite	45.20	43.50	14.45	Thin Edge Mod.
1054-35	Mudstone	21.20	14.15	5.25	Thin Edge Mod.
1054-36	Quartzite	64.35	42.05	16.45	Thick Edge Mod.
1054-40	Mudstone	9.00	9.70	3.75	Thin Edge Mod.
1054-41	Mudstone	26.15	12.85	5.90	Thin Edge Mod.
1054-42	Mudstone	17.90	10.40	5.10	Thin Edge Mod.
1054-44	Mudstone	55.05	36.40	10.65	Thin Edge Mod.
1054-45	Quartzite	58.50	29.40	16.10	Thick Edge Mod.
1054-47	Mudstone	71.20	44.65	23.60	Thick Edge Mod.
1054-49	Quartzite	26.90	15.60	5.20	Thin Edge Mod.
1054-51	Mudstone	22.70	12.90	8.55	Thin Edge Mod.
1054-54	Mudstone	44.80	34.00	7.00	Thin Edge Mod.
1054-59	Mudstone	12.05	22.55	5.20	Thin Edge Mod.
1054-63	Mudstone	51.90	38.15	11.75	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-65	Quartzite	47.55	31.45	9.90	Thin Edge Mod.
1054-77	Mudstone	26.00	16.40	9.00	Thin Edge Mod.
1054-78	Mudstone	19.45	28.15	4.95	Thin Edge Mod.
1054-79	Mudstone	44.10	18.55	7.10	Thin Edge Mod.
1054-86	Mudstone	43.00	38.60	7.85	Thin Edge Mod.
1054-87	Mudstone	39.45	22.65	10.10	Thin Edge Mod.
1054-96	Chert	33.30	16.90	4.20	Thin Edge Mod.
1054-97	Mudstone	14.90	15.40	4.10	Thin Edge Mod.
1054-99	Mudstone	14.75	13.40	5.35	Thin Edge Mod.
1054-100	Mudstone	38.45	35.45	8.60	Thin Edge Mod.
1054-101	Mudstone	30.15	36.40	5.85	Thin Edge Mod.
1054-103	Mudstone	45.40	16.20	4.40	Thin Edge Mod.
1054-105	Mudstone	16.70	17.70	7.90	Thin Edge Mod.
1054-109	Mudstone	30.50	16.90	8.60	Thin Edge Mod.
1054-111	Mudstone	12.20	8.05	1.90	Thin Edge Mod.
1054-113	Mudstone	61.80	42.90	13.05	Thin Edge Mod.
1054-114	Mudstone	18.00	17.95	3.35	Thin Edge Mod.
1054-117	Mudstone	23.00	17.85	2.20	Thin Edge Mod.
1054-121	Mudstone	22.85	25.15	2.90	Thin Edge Mod.
1054-125	Mudstone	18.95	9.25	7.85	Thin Edge Mod.
1054-129	Mudstone	57.45	49.10	18.55	Thick Edge Mod.
1054-145	Quartzite	84.70	36.00	25.65	Thick Edge Mod.
1054-146	Mudstone	25.90	23.15	6.15	Thin Edge Mod.
1054-148	Mudstone	74.70	37.45	11.90	Thin Edge Mod.
1054-149	Mudstone	21.00	15.95	2.05	Thin Edge Mod.
1054-150	Mudstone	28.75	24.90	9.25	Thin Edge Mod.
1054-151	Quartzite	59.55	55.90	18.05	Thick Edge Mod.
1054-154	Mudstone	37.60	41.35	11.70	Thin Edge Mod.
1054-157	Mudstone	67.90	81.45	30.35	Thick Edge Mod.
1054-158	Mudstone	64.40	32.95	17.90	Thick Edge Mod.
1054-159	Mudstone	7.25	17.75	2.45	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-160	Mudstone	82.20	37.85	10.60	Thin Edge Mod.
1054-161	Mudstone	17.55	11.30	5.00	Thin Edge Mod.
1054-166	Chert	29.80	16.80	4.10	Thin Edge Mod.
1054-170	Mudstone	36.25	37.50	7.50	Thin Edge Mod.
1054-171	Mudstone	29.55	17.40	11.70	Thin Edge Mod.
1054-172	Chert	17.10	21.80	8.40	Thin Edge Mod.
1054-180	Mudstone	39.70	34.25	9.95	Thin Edge Mod.
1054-204	Quartzite	110.40	94.60	36.70	Thick Edge Mod.
1054-217	Mudstone	32.45	49.75	11.90	Thin Edge Mod.
1054-232	Mudstone	57.35	91.30	15.35	Thick Edge Mod.
1054-233	Mudstone	60.25	25.40	5.75	Thin Edge Mod.
1054-240	Mudstone	25.00	29.75	4.25	Thin Edge Mod.
1054-244	Mudstone	38.60	27.45	7.50	Thin Edge Mod.
1054-248	Chert	42.40	24.25	7.00	Thin Edge Mod.
1054-249	Quartzite	54.85	36.50	9.70	Thin Edge Mod.
1054-250	Mudstone	33.20	23.35	17.75	Thick Edge Mod.
1054-252	Mudstone	16.50	24.10	8.05	Thin Edge Mod.
1054-256	Mudstone	30.25	14.25	12.75	Thin Edge Mod.
1054-260	Mudstone	37.65	18.40	4.60	Thin Edge Mod.
1054-269	Other	58.45	44.15	11.65	Thin Edge Mod.
1054-273	Mudstone	18.40	35.45	8.30	Thin Edge Mod.
1054-274	Mudstone	28.50	23.00	4.90	Thin Edge Mod.
1054-279	Mudstone	54.20	36.40	16.35	Thick Edge Mod.
1054-303	Mudstone	55.05	45.05	21.65	Thick Edge Mod.
1054-317	Mudstone	23.55	35.05	7.00	Thin Edge Mod.
1054-331	Mudstone	42.60	31.00	12.40	Thin Edge Mod.
1054-340	Mudstone	38.65	31.55	16.30	Thick Edge Mod.
1054-345	Mudstone	39.20	28.10	9.95	Thin Edge Mod.
1054-347	Mudstone	47.25	29.80	6.95	Thin Edge Mod.
1054-348	Mudstone	39.00	22.00	8.20	Thin Edge Mod.
1054-349	Mudstone	67.85	53.15	13.05	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-350	Mudstone	35.80	18.65	3.40	Thin Edge Mod.
1054-357	Mudstone	23.55	32.75	25.35	Thick Edge Mod.
1054-359	Mudstone	35.60	33.40	6.20	Thin Edge Mod.
1054-361	Mudstone	33.25	29.20	5.00	Thin Edge Mod.
1054-362	Mudstone	55.60	36.65	9.30	Thin Edge Mod.
1054-365	Mudstone	35.15	31.45	5.55	Thin Edge Mod.
1054-366	Quartzite	26.65	41.15	4.55	Thin Edge Mod.
1054-367	Mudstone	28.60	22.20	4.10	Thin Edge Mod.
1054-371	Mudstone	21.95	16.25	4.45	Thin Edge Mod.
1054-378	Mudstone	20.15	30.90	4.20	Thin Edge Mod.
1054-381	Mudstone	34.70	20.40	6.60	Thin Edge Mod.
1054-397	Mudstone	23.05	30.50	2.70	Thin Edge Mod.
1054-398	Mudstone	56.25	32.20	11.10	Thin Edge Mod.
1054-400	Mudstone	38.75	33.70	13.65	Thin Edge Mod.
1054-402	Mudstone	85.70	55.02	17.35	Thick Edge Mod.
1054-434	Mudston	39.05	24.05	8.90	Thin Edge Mod.
1054-439	Mudstone	31.55	11.50	4.00	Thin Edge Mod.
1054-440	Mudstone	22.95	14.10	2.50	Thin Edge Mod.
1054-445	Mudstone	41.85	88.50	13.20	Thin Edge Mod.
1054-452	Mudstone	74.20	57.20	17.25	Thick Edge Mod.
1054-454	Mudstone	66.40	25.15	10.80	Thin Edge Mod.
1054-487	Mudstone	28.10	11.20	2.80	Thin Edge Mod.
1054-493	Mudstone	31.25	26.30	6.85	Thin Edge Mod.
1054-545	Other	23.50	22.45	6.10	Thin Edge Mod.
1054-655	Chert	22.20	9.95	4.45	Thin Edge Mod.
1054-675	Mudstone	23.95	28.15	5.10	Thin Edge Mod.
1054-1107	Mudstone	45.25	33.10	6.70	Thin Edge Mod.
1054-1208	Mudstone	29.90	16.80	4.50	Thin Edge Mod.
1054-1215	Mudstone	46.80	27.30	13.40	Thin Edge Mod.
1054-1222	Mudstone	48.00	39.40	13.90	Thin Edge Mod.
1054-1223	Chert	47.90	23.70	5.30	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1225	Mudstone	14.20	21.00	2.65	Thin Edge Mod.
1054-1226	Mudstone	54.15	24.60	22.65	Thick Edge Mod.
1054-1230	Mudstone	22.00	22.25	3.10	Thin Edge Mod.
1054-1231	Mudstone	23.15	22.70	3.00	Thin Edge Mod.
1054-1233	Mudstone	18.80	13.10	2.00	Thin Edge Mod.
1054-1234	Mudstone	41.55	22.05	7.20	Thin Edge Mod.
1054-1235	Quartzite	41.90	25.30	9.55	Thin Edge Mod.
1054-1236	Mudstone	32.70	22.25	5.95	Thin Edge Mod.
1054-1238	Mudstone	46.40	42.35	12.40	Thin Edge Mod.
1054-1243	Mudstone	45.20	52.65	15.10	Thick Edge Mod.
1054-1245	Mudstone	87.40	33.95	17.85	Thick Edge Mod.
1054-1247	Mudstone	40.00	50.20	22.00	Thick Edge Mod.
1054-1270	Quartzite	21.65	23.75	6.30	Thin Edge Mod.
1054-1271	Mudstone	58.80	5.40	7.40	Thin Edge Mod.
1054-1272	Quartzite	32.15	31.75	5.50	Thin Edge Mod.
1054-1273	Mudstone	20.00	20.05	12.20	Thin Edge Mod.
1054-1274	Mudstone	19.60	14.65	3.70	Thin Edge Mod.
1054-1275	Mudstone	45.20	14.65	10.20	Thin Edge Mod.
1054-1278	Quartzite	45.00	60.20	16.00	Thick Edge Mod.
1054-1279	Mudstone	26.00	26.85	4.25	Thin Edge Mod.
1054-1280	Mudstone	21.20	34.75	10.80	Thin Edge Mod.
1054-1281	Mudstone	34.15	15.85	9.35	Thin Edge Mod.
1054-1282	Quartzite	23.50	26.90	7.45	Thin Edge Mod.
1054-1284	Mudstone	66.90	32.10	10.50	Thin Edge Mod.
1054-1285	Quartzite	68.15	41.50	16.00	Thick Edge Mod.
1054-1287	Mudstone	39.25	16.40	2.45	Thin Edge Mod.
1054-1288	Mudstone	28.70	23.20	3.30	Thin Edge Mod.
1054-1290	Mudstone	41.20	30.15	6.80	Thin Edge Mod.
1054-1293	Mudstone	16.25	23.80	4.35	Thin Edge Mod.
1054-1295	Quartzite	73.85	16.80	11.75	Thin Edge Mod.
1054-1296	Mudstone	48.55	39.75	11.50	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1297	Quartzite	50.35	33.50	12.90	Thin Edge Mod.
1054-1298	Mudstone	20.50	16.55	3.85	Thin Edge Mod.
1054-1300	Chert	28.90	10.80	5.00	Thin Edge Mod.
1054-1304	Mudstone	10.50	9.25	3.50	Thin Edge Mod.
1054-1305	Other	10.65	11.55	2.15	Thin Edge Mod.
1054-1307	Mudstone	21.45	11.40	5.15	Thin Edge Mod.
1054-1308	Mudstone	24.00	15.20	3.50	Thin Edge Mod.
1054-1310	Mudstone	31.75	27.35	7.65	Thin Edge Mod.
1054-1312	Mudstone	25.50	29.75	4.45	Thin Edge Mod.
1054-1316	Mudstone	27.80	16.10	6.05	Thin Edge Mod.
1054-1325	Quartzite	60.05	43.45	22.00	Thick Edge Mod.
1054-1334	Quartzite	55.25	58.75	15.70	Thick Edge Mod.
1054-1339	Mudstone	91.90	40.90	18.65	Thick Edge Mod.
1054-1343	Mudstone	86.80	59.10	34.60	Thick Edge Mod.
1054-1350	Mudstone	85.35	34.15	27.25	Thick Edge Mod.
1054-1376	Mudstone	20.70	18.70	3.55	Thin Edge Mod.
1054-1379	Mudstone	21.20	14.55	3.65	Thin Edge Mod.
1054-1386	Mudstone	34.40	22.90	7.80	Thin Edge Mod.
1054-1390	Quartzite	15.40	15.60	3.70	Thin Edge Mod.
1054-1391	Mudstone	23.95	14.05	3.35	Thin Edge Mod.
1054-1392	Quartzite	26.85	16.45	7.00	Thin Edge Mod.
1054-1395	Chert	20.05	23.20	3.75	Thin Edge Mod.
1054-1396	Mudstone	39.50	30.80	5.85	Thin Edge Mod.
1054-1401	Mudstone	71.85	48.30	25.35	Thick Edge Mod.
1054-1402	Quartzite	47.30	63.20	31.20	Thick Edge Mod.
1054-1403	Mudstone	28.70	17.45	5.05	Thin Edge Mod.
1054-1406	Mudstone	34.20	24.35	6.20	Thin Edge Mod.
1054-1408	Chert	23.25	14.35	4.90	Thin Edge Mod.
1054-1410	Mudstone	25.10	17.60	6.40	Thin Edge Mod.
1054-1412	Chert	26.00	19.75	5.85	Thin Edge Mod.
1054-1413	Mudstone	27.75	13.65	2.15	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1414	Chert	14.60	23.55	3.15	Thin Edge Mod.
1054-1429	Mudstone	29.05	25.60	6.35	Thin Edge Mod.
1054-1430	Mudstone	47.40	38.25	6.70	Thin Edge Mod.
1054-1431	Quartzite	27.55	19.55	5.40	Thin Edge Mod.
1054-1434	Mudstone	35.30	22.30	8.55	Thin Edge Mod.
1054-1435	Mudstone	19.10	16.15	8.40	Thin Edge Mod.
1054-1438	Other	29.55	30.75	10.55	Thin Edge Mod.
1054-1439	Mudstone	44.45	39.65	6.30	Thin Edge Mod.
1054-1451	Quartzite	34.15	21.90	5.80	Thin Edge Mod.
1055-24	Mudstone	39.55	26.80	8.70	Thin Edge Mod.
1057-8	Quartzite	39.90	40.10	7.10	Thin Edge Mod.
1057-13	Mudstone	31.00	18.45	3.90	Thin Edge Mod.
1058-4	Chert	35.65	24.45	7.15	Thin Edge Mod.
1058-5	Mudstone	19.65	20.70	5.10	Thin Edge Mod.
1058-9	Chert	31.30	14.50	4.70	Thin Edge Mod.
1058-11	Mudstone	48.65	38.75	15.50	Thin Edge Mod.
1058-17	Mudstone	28.45	14.65	3.30	Thin Edge Mod.
1058-122	Chert	14.30	16.90	2.25	Thin Edge Mod.
1058-264	Mudstone	32.50	19.35	3.40	Thin Edge Mod.
1058-265	Mudstone	31.15	11.60	5.75	Thin Edge Mod.
1058-270	Mudstone	72.80	27.40	6.95	Thin Edge Mod.
1059-19	Mudstone	26.30	19.15	5.05	Thin Edge Mod.
1059-22	Mudstone	32.80	31.75	9.05	Thin Edge Mod.
1059-25	Mudstone	34.15	12.85	5.45	Thin Edge Mod.
1059-36	Quartzite	33.75	25.00	9.10	Thin Edge Mod.
1060-1	Mudstone	33.35	39.20	9.60	Thin Edge Mod.
1060-2	Chert	52.80	20.45	6.05	Thin Edge Mod.
1060-4	Mudstone	48.25	39.25	12.25	Thin Edge Mod.
1060-11	Mudstone	38.25	21.00	7.30	Thin Edge Mod.
1060-19	Mudstone	71.60	77.25	25.35	Thick Edge Mod.
1060-25	Mudstone	75.65	40.90	18.25	Thick Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1060-31	Mudstone	50.35	43.70	9.80	Thin Edge Mod.
1060-32	Chert	28.25	18.00	7.85	Thin Edge Mod.
1060-33	Quartzite	54.10	35.60	16.15	Thick Edge Mod.
1060-34	Quartzite	113.50	82.00	29.90	Thick Edge Mod.
1060-42	Mudstone	35.90	25.65	14.35	Thin Edge Mod.
1073-1	Mudstone	32.45	19.30	4.05	Thin Edge Mod.
1073-2	Mudstone	32.65	47.50	8.95	Thin Edge Mod.
1073-2 (west)	Mudstone	43.45	119.40	11.70	Thin Edge Mod.
1073-8	Quartzite	39.80	16.50	6.00	Thin Edge Mod.
1073-10	Mudstone	19.20	21.50	5.20	Thin Edge Mod.
1073-14	Quartzite	34.30	45.05	8.85	Thin Edge Mod.
1073-17	Quartzite	25.70	12.35	4.70	Thin Edge Mod.
1073-37	Mudstone	75.35	47.60	17.60	Thick Edge Mod.
1073-38	Mudstone	20.05	18.95	4.20	Thin Edge Mod.
1073-47	Quartzite	77.85	50.80	25.00	Thick Edge Mod.
1073-51	Mudstone	14.95	11.90	1.95	Thin Edge Mod.
1073-52	Mudstone	22.85	34.60	6.40	Thin Edge Mod.
1073-58	Mudstone	50.15	33.20	10.30	Thin Edge Mod.
1073-120	Mudstone	30.50	18.75	6.10	Thin Edge Mod.
1073-168	Mudstone	26.80	25.90	6.05	Thin Edge Mod.
1073-185	Mudstone	69.90	53.95	12.50	Thin Edge Mod.
1073-255	Quartzite	63.30	52.55	26.15	Thick Edge Mod.
1073-261	Quartzite	51.85	30.30	18.85	Thick Edge Mod.
1073-279	Mudstone	19.80	29.45	5.05	Thin Edge Mod.
1073-280	Chert	27.45	25.00	4.25	Thin Edge Mod.
1073-79/S/35	Mudstone	74.95	65.95	9.95	Thin Edge Mod.
1073-79/S/39	Mudstone	43.20	26.60	7.60	Thin Edge Mod.
1073-79/S/46	Mudstone	28.00	29.80	7.00	Thin Edge Mod.
1074-3	Mudstone	23.05	16.90	7.65	Thin Edge Mod.
1074-10	Mudstone	20.80	21.35	4.90	Thin Edge Mod.
1074-11	Mudstone	21.10	17.60	5.35	Thin Edge Mod.

Table D-41. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1074-18	Mudstone	28.10	33.15	6.75	Thin Edge Mod.
1074-23	Mudstone	49.90	25.95	12.50	Thin Edge Mod.
1074-28	Mudstone	38.50	30.20	9.75	Thin Edge Mod.
1074-29	Mudstone	37.25	15.05	5.85	Thin Edge Mod.
1074-35	Mudstone	42.80	31.70	11.50	Thin Edge Mod.
1074-44	Mudstone	42.10	26.65	9.20	Thin Edge Mod.
1076-5	Mudstone	40.30	25.80	10.20	Thin Edge Mod.
1086-8	Quartzite	35.70	23.05	7.00	Thin Edge Mod.
1086-9	Mudstone	26.10	24.50	4.85	Thin Edge Mod.
1087-8	Mudstone	20.80	27.15	3.35	Thin Edge Mod.
1087-20	Mudstone	21.70	24.00	7.70	Thin Edge Mod.
1087-22	Chert	23.20	9.85	4.50	Thin Edge Mod.
1087-23	Mudstone	31.70	16.70	9.25	Thin Edge Mod.
1097-3	Mudstone	27.10	21.35	6.50	Thin Edge Mod.
1144-2	Mudstone	39.50	16.50	7.45	Thin Edge Mod.
1144-4	Chert	24.00	18.60	5.15	Thin Edge Mod.
1144-10	Mudstone	26.65	11.05	3.70	Thin Edge Mod.
IA-14	Mudstone	22.40	19.00	6.25	Thin Edge Mod.

Table D-42. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Edge Modified Cobbles, Classes: Bifacial (N=11), Unifacial (N=24), and Notched (N=10).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Bifacial					
376-3	Mudstone	64.60	59.85	20.80	Thick Edge Mod.
385-126	Mudstone	72.90	56.35	33.35	Thick Edge Mod.
392-5	Mudstone	64.20	36.30	15.60	Thick Edge Mod.
1054-195	Quartzite	106.50	62.50	45.70	Thick Edge Mod.
1054-1354	Mudstone	78.10	48.25	30.30	Thick Edge Mod.
1054-1357	Mudstone	72.20	47.00	26.35	Thick Edge Mod.
1056-6	Mudstone	98.10	87 20	16.55	Thick Edge Mod.
1059-10	Mudstone	48.30	40.00	15.25	Thick Edge Mod.
1073-79/S/30	Quartzite	112.25	86.10	27.50	Thick Edge Mod.
1073-79/S/37	Mudstone	75.80	49.20	20.50	Thick Edge Mod.
1073-282	Other	109.80	109.95	23.95	Thick Edge Mod.
Unifacial					
190-14	Mudstone	51.80	74.60	10.60	Thin Edge Mod.
193-4	Mudstone	72.15	57.45	19.55	Thick Edge Mod.
193-79/S/13	Quartzite	125.10	117.30	40.30	Thick Edge Mod.
364-23	Mudstone	78.25	58.00	22.95	Thick Edge Mod.
364-29	Quartzite	102.90	74.40	28.40	Thick Edge Mod.
386-5	Mudstone	42.90	28.25	14.55	Thin Edge Mod.
388-1	Mudstone	91.25	77.20	17.65	Thick Edge Mod.
388-18	Mudstone	66.15	42.85	12.70	Thin Edge Mod.
388-23	Mudstone	97.80	77.15	19.10	Thick Edge Mod.
388-38	Mudstone	94.20	87.35	28.35	Thick Edge Mod.
388-59	Mudstone	104.50	107.20	38.20	Thick Edge Mod.
388-214	Mudstone	79.85	52.20	20.65	Thick Edge Mod.
388-215	Mudstone	86.60	67.75	15.45	Thick Edge Mod.
656-197	Mudstone	145.20	68.25	50.60	Thick Edge Mod.
656-199	Mudstone	116.40	68.20	27.25	Thick Edge Mod.
698-1	Mudstone	95.50	52.10	21.90	Thick Edge Mod.
1054-119	Mudstone	52.40	50.30	11.50	Thin Edge Mod.

Table D-42. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Unifacial					
1054-135	Quartzite	88.75	48.35	31.40	Thick Edge Mod.
1054-178	Mudstone	86.55	66.40	22.75	Thick Edge Mod.
1054-1431	Mudstone	86.20	56.10	14.20	Thin Edge Mod.
1058-257	Quartzite	118.20	111.60	62.50	Thick Edge Mod.
1058-297	Mudstone	128.70	94.40	30.50	Thick Edge Mod.
1073-79/S/16	Mudstone	37.20	28.55	9.50	Thin Edge Mod.
1073-.71	Mudstone	52.60	37.65	14.80	Thin Edge Mod.
Notched					
372-3	Other	88.70	85.00	29.60	Net Weight
396-4	Mudstone	97.55	51.70	23.55	Net Weight
396-6	Mudstone	77.90	32.20	32.35	Net Weight
419-3	Mudstone	80.90	67.20	13.25	Net Weight
427-1	Mudstone	68.10	54.25	10.35	Net Weight
656-189	Mudstone	116.35	88.95	30.40	Net Weight
1054-1359	Mudstone	95.60	65.60	18.90	Net Weight
1073-235	Mudstone	55.50	30.75	18.90	Net Weight
1073-290	Mudstone	141.10	72.85	14.70	Net Weight
1148-79/S/1	Mudstone	87.40	45.35	10.45	Net Weight

Table D-43. Metric (mm) and Material Type Attributes for Morpho/Techno Class End/Edges Battered Cobbles N=78.

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
364-13	Quartzite	95.50	63.60	48.10	Hammer/Anvil Stone
365-11	Other	120.50	69.85	50.75	Hammer/Anvil Stone
365-12	Other	91.30	65.50	19.45	Hammer/Anvil Stone
365-13	Other	139.40	63.35	43.80	Hammer/Anvil Stone
365-14	Mudstone	154.00	105.50	68.50	Hammer/Anvil Stone
365-15	Other	57.40	51.65	31.50	Hammer/Anvil Stone
365-17	Other	45.70	40.05	32.50	Hammer/Anvil Stone
365-18	Quartzite	103.20	64.00	57.60	Hammer/Anvil Stone
365-25	Other	114.05	94.40	69.50	Hammer/Anvil Stone
372-1	Mudstone	134.40	63.95	36.80	Hammer/Anvil Stone
372-2	Other	94.70	69.90	29.20	Hammer/Anvil Stone
372-4	Mudstone	55.10	52.95	39.80	Hammer/Anvil Stone
376-2	Mudstone	110.03	79.44	49.96	Hammer/Anvil Stone
385-123	Other	93.20	62.25	33.00	Hammer/Anvil Stone
385-124	Quartzite	97.90	78.75	44.50	Hammer/Anvil Stone
386-76	Mudstone	91.10	85.50	40.35	Hammer/Anvil Stone
386-82	Quartzite	88.60	76.85	40.90	Hammer/Anvil Stone
386-86	Quartzite	49.50	48.05	24.10	Hammer/Anvil Stone
387-87	Quartzite	98.25	83.10	39.70	Hammer/Anvil Stone
387-88	Quartzite	120.70	77.60	59.95	Hammer/Anvil Stone
388-37	Quartzite	74.20	54.20	52.05	Hammer/Anvil Stone
388-43	Other	68.20	52.25	38.85	Hammer/Anvil Stone
388-60	Other	93.40	53.55	51.80	Hammer/Anvil Stone
388-211	Other	98.80	73.20	32.55	Hammer/Anvil Stone
394-7	Mudstone	141.40	62.80	58.45	Hammer/Anvil Stone
396-3	Other	72.40	71.40	56.80	Hammer/Anvil Stone
396-7	Quartzite	186.00	108.55	103.15	Hammer/Anvil Stone
422-2	Mudstone	71.15	73.10	50.25	Hammer/Anvil Stone
488-4	Quartzite	98.55	62.55	51.15	Hammer/Anvil Stone
515-1	Quartzite	116.20	65.80	46.50	Hammer/Anvil Stone

Nonflaked Lithic Artifacts (Miranda Warburton)

There are six major subcategories of nonflaked lithic artifacts. In general, these consist of any stone artifacts which have been used, modified or modified by use, but have not been flaked.

Battered Stone Objects

These artifacts (N=99) are battered, usually from use. Battering, that may be from use as a hammerstone or anvil, is evidenced as discrete areas of indentations which have disrupted the natural cortex of the cobble. This category is subdivided, based on the location of the indentations.

End and/or Sides (N=78)

Artifacts in this class have battering scars on the end(s) and/or side(s). Of these 78 artifacts, 13 were used with enough force to remove flakes leaving flake scars and step fractures on the ends of the cobbles. These artifacts are usually made on oval river cobbles. Apparently they were used for heavy pounding. Quartzites predominate, but mudstones, sandstones, and granitic rocks are represented (Table D-43).

One of the artifacts (24LN1054-1319) is a broken, cylindrical mudstone piece which is battered on one end and appears to have a lightly ground surface. The other mudstone artifacts are generally irregular in shape. They range in size from small to medium. Use-wear is moderate and generally in discrete areas.

The quartzite artifacts tend to be river cobbles ranging in size from 4.0 to 9.0 cm in diameter. The location of use-wear varies from cobble to cobble: both ends battered, one end battered, both ends and one side battered, and all sides or edges battered.

The granitic artifacts are also river cobbles, ranging in size from ca. 4.0 to 8.0 cm in diameter. The amount of battering tends to be moderate and occurs on both ends. However, there is one (24LN656-203) with very heavy battering on one end and one side.

Face/Faces (N=8)

Artifacts in this class tend to exhibit relatively small (less than 3 cm in diameter) depressions on one or both faces. The depressions are probably the result of heavy pounding in a discrete area. Both tabular and subrounded rocks are included in the class. These artifacts may have functioned as anvil stones, but it is possible that they were used as hammerstones (Table D-44).

Table D-43. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
656-194	Quartzite	95.40	69.70	56.00	Hammer/Anvil Stone
656-203	Other	128.80	118.30	67.80	Hammer/Anvil Stone
692-6	Other	112.75	92.25	41.60	Hammer/Anvil Stone
698-2	Mudstone	121.80	88.95	46.80	Hammer/Anvil Stone
706-33	Quartzite	99.90	81.70	51.00	Hammer/Anvil Stone
706-36	Quartzite	106.00	76.30	53.00	Hammer/Anvil Stone
1054-130	Quartzite	73.40	52.40	45.70	Hammer/Anvil Stone
1054-131	Mudstone	81.20	47.35	30.25	Hammer/Anvil Stone
1054-137	Quartzite	67.60	49.60	49.55	Hammer/Anvil Stone
1054-138	Quartzite	75.65	55.50	46.30	Hammer/Anvil Stone
1054-139	Quartzite	146.80	85.80	60.40	Hammer/Anvil Stone
1054-162	Quartzite	42.35	58.45	40.20	Hammer/Anvil Stone
1054-175	Other	64.30	53.25	35.15	Hammer/Anvil Stone
1054-182	Quartzite	62.25	49.35	46.10	Hammer/Anvil Stone
1054-185	Mudstone	71.10	48.05	41.50	Hammer/Anvil Stone
1054-191	Mudstone	80.00	79.20	45.80	Hammer/Anvil Stone
1054-196	Mudstone	90.45	52.25	30.25	Hammer/Anvil Stone
1054-202	Mudstone	140.00	95.40	49.00	Hammer/Anvil Stone
1054-203	Quartzite	119.60	93.75	59.30	Hammer/Anvil Stone
1054-211	Quartzite	96.60	74.85	47.35	Hammer/Anvil Stone
1054-215	Quartzite	65.00	61.85	43.85	Hammer/Anvil Stone
1054-457	Quartzite	96.60	70.00	60.00	Hammer/Anvil Stone
1054-458	Quartzite	66.70	47.30	44.60	Hammer/Anvil Stone
1054-465	Quartzite	56.90	45.00	29.70	Hammer/Anvil Stone
1054-471	Quartzite	89.60	84.20	40.00	Hammer/Anvil Stone
1054-1253	Quartzite	105.80	94.55	60.10	Hammer/Anvil Stone
1054-1256	Quartzite	111.60	93.85	58.65	Hammer/Anvil Stone
1054-1258	Other	115.90	108.00	50.00	Hammer/Anvil Stone
1054-1319	Mudstone	70.45	44.45	37.00	Hammer/Anvil Stone
1054-1362	Mudstone	128.20	92.40	50.50	Hammer/Anvil Stone

Table D-43. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-1363	Quartzite	62.30	56.95	34.00	Hammer/Anvil Stone
1054-1364	Quartzite	70.75	56.30	34.65	Hammer/Anvil Stone
1054-1366	Other	73.80	55.50	45.80	Hammer/Anvil Stone
1054-1368	Mudstone	77.00	67.40	26.60	Hammer/Anvil Stone
1054-1372	Other	104.00	76.00	44.35	Hammer/Anvil Stone
1054-1381	Quartzite	63.60	52.30	45.30	Hammer/Anvil Stone
1055-4	Quartzite	71.80	70.35	40.20	Hammer/Anvil Stone
1055-7	Mudstone	99.80	43.00	40.85	Hammer/Anvil Stone
1058-271	Mudstone	61.50	51.65	43.30	Hammer/Anvil Stone
1058-289	Other	72.00	56.70	36.35	Hammer/Anvil Stone
1060-20	Quartzite	102.90	91.80	40.45	Hammer/Anvil Stone
1060-21	Quartzite	84.80	70.05	52.65	Hammer/Anvil Stone
1073-33	Other	76.35	57.95	43.35	Hammer/Anvil Stone
1073-44	Mudstone	83.90	41.45	25.35	Hammer/Anvil Stone
1073-49	Quartzite	110.45	82.00	55.30	Hammer/Anvil Stone
1073-53	Quartzite	136.55	91.90	61.15	Hammer/Anvil Stone
1073-281	Other	73.30	50.10	46.40	Hammer/Anvil Stone
1074-8	Quartzite	110.55	83.65	55.10	Hammer/Anvil Stone

Edge(s) and Face(s) (N=13)

These artifacts exhibit evidence of battering on one or more edges as well as on one or both faces. They may have been used as anvil stones or hammerstones or a combination of both. Four of the artifacts are quartzite river cobbles (Table D-44). Two of them are medium sized cobbles with small to moderate amounts of battering on both faces and at least one edge. Another is a small cobble lightly battered on both ends and one face. Five of the edge and face battered cobbles are granitic cobbles approximately 7.5 cm in diameter with light to moderate battering on the faces and edges. One small mudstone cobble (24LN1054-1382) is present; it has battered edges and one battered face; the reverse face has a number (ca. 20) of small shallow incisions or stria. Specimen 24LN1054-1385 is a medium size coarse grain sandstone piece, heavily battered on both faces and along the edges.

The battered stone category includes a variety of artifact types. Some may have been held stationary and used as anvils, others appear to be hammerstones used in lithic reduction. Still others may have been used for some kinds of heavy-duty pounding activities (e.g., to fracture bones or crush vegetal materials), as indicated by step fractured flake scars.

Pecked Stone Objects

These are artifacts shaped by pecking as opposed to battering or grinding. There may have been subsequent grinding of the pecked surfaces, but primary shaping was achieved by pecking. Pecking is indicated by regular, patterned indentations covering part or all of the surface of the artifact. This subcategory is divided into three classes based on type of pecking and shape of end product.

Surface (Pestles) (N=5)

The collection contains five pestles from five sites (Figure 8-20). All are basically cylindrical in shape and made from relatively coarse grain metamorphic rocks (Table D-45).

Three of the specimens (24LN423-65, 24LN1066-2 and 24LN1055-13) have ends that appear heavily used. They are all slightly tapering and the largest (i.e., distal) end appears to be the working surface. However, judging from the use-wear, both ends of the complete specimen (24LN1066-2) were used. One specimen (24LN1073-283) is only a fragment of the distal end of a pestle, but it is very similar to the more complete specimens. The remaining specimen (24LN1054-1252) is more accurately described as a tapering wedge shaped object. It is the only one of the pecked stone items that is missing the large end, but the wedge shaped or small end is well pecked and heavily utilized.

Table D-44. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Battered Cobbles, Classes: Face/Faces (N=8) and Edge/Faces (N=13).

Site Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Face/Faces					
369-1	Quartzite	234.00	167.00	67.90	Hammer/Anvil Stone
708-11	Quartzite	106.20	96.00	51.35	Hammer/Anvil Stone
712-8	Mudstone	475.00	320.00	57.30	Hammer/Anvil Stone
1054-199	Mudstone	107.85	46.75	38.25	Hammer/Anvil Stone
1054-1358	Other	121.90	113.60	68.25	Hammer/Anvil Stone
1054-1365	Other	73.75	52.15	37.50	Hammer/Anvil Stone
1054-1380	Mudstone	123.40	96.50	32.75	Hammer/Anvil Stone
1058-274	Mudstone	182.00	102.50	32.75	Hammer/Anvil Stone
Edge/Faces					
365-22	Mudstone	121.70	95.20	59.35	Hammer/Anvil Stone
385-115	Quartzite	125.20	98.30	61.35	Hammer/Anvil Stone
386-81	Other	93.35	82.55	43.05	Hammer/Anvil Stone
417-71	Other	100.40	80.05	41.65	Hammer/Anvil Stone
656-200	Other	183.00	134.25	43.00	Hammer/Anvil Stone
1054-201	Mudstone	108.20	94.40	56.00	Hammer/Anvil Stone
1054-208	Quartzite	91.90	75.25	47.30	Hammer/Anvil Stone
1054-296	Quartzite	85.80	68.90	28.60	Hammer/Anvil Stone
1054-461	Mudstone	89.50	72.00	30.40	Hammer/Anvil Stone
1054-1382	Mudstone	55.15	43.55	28.90	Hammer/Anvil Stone
1054-1385	Other	59.35	45.65	27.95	Hammer/Anvil Stone
1055-12	Other	86.35	72.85	66.30	Hammer/Anvil Stone
1146-1	Quartzite	250.00	112.50	73.25	Hammer/Anvil Stone

Curves (Grooved Maul) (N=2)

These items (Figure 8-21, b) have a readily observable pecked and sometimes ground channel or full groove around the circumference of the artifact. The two full grooved items are quite dissimilar (Table D-45). One (24LN1076-8) is a large, fully grooved, quartzite cobble which probably functioned as a maul. The groove is quite irregular. The only shaping of the artifact appears to be the full groove, although there is extensive battering on the ends. The other item (24LN1054-446) is a small, metamorphic sandstone, fully grooved, ovoid shaped object. It does not appear to be battered but probably was shaped by pecking. The function of the artifact remains undetermined.

Straight (Grooved Abraders) (N=2)

These items (Figure 8-21, a, c) have a readily observable pecked and sometimes ground channel running the length of the artifact. Both artifacts (24LN189-79/S/4 and 24LN1054-292) are made of sandstone (Table D-45). Traditionally, similar artifacts are reffered to as shaft smoothers or abraders.

Ground Stone Objects

This subcategory includes artifacts (N=34) with a surface which appears to be ground and is notably smoother than those in the pecked subcategory. Ground stone objects are further divided into two classes based on the location of the ground surface(s).

End and/or Edges (N=21)

These are the kinds of tools traditionally called edge-ground cobbles. The following permutations of the location of ground surfaces are included in the class: 1) 12 with one edge ground; 2) seven with two edges ground; 3) one with four edges ground; and 4) one with one end ground (Table D-46). All but two are coarse grain granitic river cobbles. The two exceptions are in the one edge ground group and both are made from a grey mudstone. One (24LN417-70) is irregular in shape due to fracture. It has a heavily pecked and ground edge, while the other edges are battered. The other (24LN1054-277) is an irregular cylinder shaped stone with one of the long edges heavily ground and the two other long edge lightly ground. There is also some evidence of battering on one end of this object. Nine of the 12 one edge ground cobbles are subovoid in shape, with pronounced pecking and grinding along one edge which is usually straight rather than curved.

The cobbles with two edges ground are slightly more irregular in shape (one subtriangular, one subrectangular, and five subovoid), but they are made of granitic material. With one exception, the edges are markedly pecked and ground, almost to a polish in some cases. The exception appears to have been lightly pecked and ground on two edges,

Table D-45. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Pecked Stone Tools, Classes: Curves (N=2), Straight (N=2), and Surface (N=5).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Curves					
1054-446	Other	44.70	30.00	28.20	Grooved Maul
1076-8	Quartzite	109.60	84.45	75.65	Grooved Maul
Straight					
189-79/S/4	Other	43.30	31.50	22.30	Abraider
1054-292	Other	60.85	35.50	29.70	Abraider
Surface					
423-65	Mudstone	270.00	58.65	58.65	Pestle
1054-1252	Other	151.70	47.30	34.00	Pestle
1055-13	Mudstone	152.25	55.80	55.80	Pestle
1066-2	Other	220.70	65.30	53.50	Pestle
1073-283	Mudstone	105.80	52.60	24.65	Pestle

Table E-2. (Continued)

Taxon	Site Number 24LN....										
	419	423	427	429	443	447	521	653	655	656	657
Unidentifiable		.1	3.2	2.3	1.5	1.8	<.1			5.7	
Mammal											
Medium/Large		2.0	6.0	1.9	3.0	.8	<.1			18.2	
Large		9.2	3.6	3.4	8.4	1.1		24.9		20.6	
Medium	25.3	11.7	15.9	5.7	11.2	6.4			.9	167.5	10.7
Small			1.3	.4	.1	.2				.6	
Very Small			<.1							<.1	
Cervidae											
Felidae											
Mustelidae											
Leporidae				<.1							
Sciuridae											
Geomyidae					.1						
Bos/Bison			87.3								
Bos sp. and *B. taurus*			127.3								57.1
Equus caballus											
Cervus canadensis											
Rangifer caribou											
Odocoileus sp.		2.2	8.4	1.3	1.3					576.4	24.2
O. hemionus											
O. virginianus											
Ovis sp. and *O. aries*											
Ursus sp.											
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined			.1	.1							
Catostomidae				.3							
Salmonidae			<.1								
Bird and Turtle			.1			<.1					
Mollusc											
Shell Undetermined and River Mussel			.2								
Land Snail											
TOTAL	25.3	25.2	253.5	15.4	25.6	10.3	.1	24.9	.9	789.0	92.0

Table E-2. (Continued)

Taxon	Site Number 24LN....										
	387	388	389	392	394	396	399	400	402	417	418
Unidentifiable		.3		.8	<.1	.1	.2	3.6	.3	1.5	
Mammal											
Medium/Large		1.1		<.1						1.7	
Large		.2		247.6						1.2	76.8
Medium	17.2	3.3	2.5	39.5	<.1	.7	.4	23.9	.2	11.0	
Small		.1		28.3				.7	<.1	.1	
Very Small	<.1										
Cervidae									.3		1.4
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison				49.2							
Bos sp. and B. taurus				264.2							
Equus caballus											
Cervus canadensis				562.6							
Rangifer caribou											
Odocoileus sp.		109.5									
O. hemionus				53.1							
O. virginianus				30.4							
Ovis sp. and O. aries											
Ursus sp.											
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined										<.1	
Catostomidae											
Salmonidae					<.1						
Bird and Turtle						.3		<.1			
Mollusc											
Shell Undetermined and River Mussel										<.1	
Land Snail	<.1					<.1					
TOTAL	17.3	114.5	2.5	1275.7	<.1	1.1	.6	28.2	.8	15.6	78.2

Table E-2. Taxa Recovered from the Project Area by Weight in Grams.

Taxon	Site Number 24LN....										
	190	364	365	366	369	372	375	376	377	385	386
Unidentifiable	<.1	.1	.4	.4	<.1				.3	.4	<.1
Mammal											
Medium/Large	1.0	1.0		.1				1.1	.8	.3	.2
Large			1.1	14.3							26.3
Medium		1.3	3.2	76.1	1.1			1.3		2.9	57.7
Small		0.1	.3	.5							.8
Very Small				<.1							
Cervidae		71.7									
Felidae											
Mustelidae											
Leporidae											
Sciuridae			<.1								
Geomyidae											
Bos/Bison				18.3							
Bos sp. and *B. taurus*											
Equus caballus											
Cervus canadensis				2.9						305.3	
Rangifer caribou											
Odocoileus sp.				51.6		20.4				23.2	
O. hemionus											
O. virginianus											
Ovis sp. and *O. aries*											77.2
Ursus sp.											
Canis sp.											6.6
C. lupus							474.8				
C. familiaris											
Lepus sp.											2.4
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined				1.3						<.1	.1
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel										<.1	
Land Snail	<.1									<.1	
TOTAL	1.1	74.2	5.1	165.5	1.1	20.4	474.8	2.4	1.1	332.2	171.3

Table E-1. (Continued)

Taxon	Site Number 24LN.... 1064	1073	1074	1076	1086	1087	1097	1144	Across from 392
Unidentifiable	3	3	8			69	5	6	
Mammal									
Medium/Large		2	1			2		5	
Large		9	1	1		3			
Medium		14	13		1	29	2	24	3
Small		4	6			10		2	
Very Small		8				1	1		
Cervidae						2			
Felidae									
Mustelidae		2							
Leporidae		1	3			1			
Sciuridae									
Geomyidae								2	
Bos/Bison						1			
Bos sp. and B. taurus		26							
Equus caballus				1					
Cervus canadensis		4							
Rangifer caribou									
Odocoileus sp.		1							1
O. hemionus									
O. virginianus									
Ovis sp. and O. aries						1		1	1
Ursus sp.									
Canis sp.									
C. lupus									
C. familiaris								1	
Lepus sp.		2							
Sylvilagus nuttallii						1			
Marmota sp.			1						
Sciurus sp.		2							
Thomomys talpoides			1					1	
Onychomys leucogaster		3							
Fish									
Undetermined						1	1		
Catostomidae									
Salmonidae									
Bird and Turtle		2	1					2	
Mollusc									
Shell Undetermined and River Mussel									
Land Snail							1		
TOTAL	3	83	35	2	1	121	10	44	5

Table E-1. (Continued)

Taxon	Site Number 24LN....										
	701	704	706	707	708	711	1054	1055	1058	1059	1060
Unidentifiable				3	21	1	167	1	1		6
Mammal											
Medium/Large				1	16		64		2	9	
Large	2				32	1	70	1	2	2	1
Medium	1			4	7	2	268		3		3
Small				1			64		1		2
Very Small						3	2		2		
Cervidae							2				
Felidae							1				
Mustelidae											
Leporidae							41				
Sciuridae											
Geomyidae											
Bos/Bison	1										
Bos sp. and *B. taurus*											
Equus caballus	1										
Cervus canadensis											
Rangifer caribou											
Odocoileus sp.						1		1			1
O. hemionus					2						
O. virginianus											
Ovis sp. and *O. aries*							1				
Ursus sp.											
Canis sp.									1		
C. lupus							1				
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.	1										
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined											
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel		1	1				3				
Land Snail			3			9	13				
TOTAL	6	1	4	9	78	17	697	3	12	11	13

Table E-1. (Continued)

Taxon	Site Number 24LN....										
	674	675	677	679	683	685	686	691	696	697	700
Unidentifiable		3	297	5	1			7	1		
Mammal											
Medium/Large		1	268	56							1
Large			65	22							
Medium			442	64	4			1			19
Small			22	3	2						
Very Small											
Cervidae											
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison											
Bos sp. and B. taurus											
Equus caballus	2							1			
Cervus canadensis										1	
Rangifer caribou											1
Odocoileus sp.			2			1	1		2		
O. hemionus								1	1		
O. virginianus				1							
Ovis sp. and O. aries								1	1		2
Ursus sp.											
Canis sp.			5			1					
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined								64			
Catostomidae											
Salmonidae											
Bird and Turtle		1	1								
Mollusc											
Shell Undetermined and River Mussel			1								
Land Snail								11			
TOTAL	2	5	1103	151	7	2	1	86	5	1	23

Table E-1. (Continued)

Taxon	Site Number 24LN....										
	660	661	662	663	664	665	666	667	668	671	672
Unidentifiable		1					55			3	
Mammal											
Medium/Large		1	1				15				
Large	1	5		1	1	1	7				
Medium		9	1	1	1		10			1	
Small							3				
Very Small											
Cervidae											
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison		1		1			3				2
Bos sp. and B. taurus	5	2					1				1
Equus caballus								1			
Cervus canadensis									1		
Rangifer caribou											
Odocoileus sp.		3									
O. hemionus											
O. virginianus											
Ovis sp. and O. aries											
Ursus sp.											1
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.						1					
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined							1				
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel											
Land Snail							7				
TOTAL	6	22	2	3	2	2	102	1	1	4	4

Table E-1. (Continued)

Taxon	Site Number 24LN....										
	419	423	427	429	443	447	521	653	655	656	657
Unidentifiable		2	192	50	16	34	1			60	
Mammal											
Medium/Large		8	93	21	24	1	1			119	
Large		1	14	3	14	3		1		45	
Medium	6	18	52	36	45	24			1	79	1
Small			23	10	3	3				14	
Very Small			2							1	
Cervidae											
Felidae											
Mustelidae											
Leporidae				2							
Sciuridae											
Geomyidae					7						
Bos/Bison			1								
Bos sp. and B. taurus			1								1
Equus caballus											
Cervus canadensis											
Rangifer caribou											
Odocoileus sp.		1	1	1	1					13	1
O. hemionus											
O. virginianus											
Ovis sp. and O. aries											
Ursus sp.											
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined			4	4							
Catostomidae				1							
Salmonidae			3								
Bird and Turtle			2			2					
Mollusc											
Shell Undetermined and River Mussel			3								
Land Snail											
TOTAL	6	30	391	128	110	67	2	1	1	331	3

Table E-1. (Continued)

Taxon	Site Number 24LN....										
	387	388	389	392	394	396	399	400	402	417	418
Unidentifiable		11		22	1	3	3	57	6	34	
Mammal											
Medium/Large		7		1						10	
Large		1		14						2	2
Medium	1	14	1	3	1	5	2	55	2	19	
Small		3		1				10	1	2	
Very Small	1										
Cervidae									2		1
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison				1							
Bos sp. and *B. taurus*				2							
Equus caballus											
Cervus canadensis				4							
Rangifer caribou											
Odocoileus sp.		1									
O. hemionus				2							
O. virginianus				3							
Ovis sp. and *O. aries*											
Ursus sp.											
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined										1	
Catostomidae											
Salmonidae					1						
Bird and Turtle						1		1			
Mollusc											
Shell Undetermined and River Mussel										2	
Land Snails	4					1					
TOTAL	6	37	1	53	3	10	5	123	11	70	3

Table E-1. Taxa Recovered from the Project Area by Number of Specimens.

Taxon	Site Number 24LN....										
	190	364	365	366	369	372	375	376	377	385	386
Unidentifiable	1	1	9	6	1				7	8	2
Mammal											
Medium/Large		1		1				2	9	6	1
Large			1	14							1
Medium	1	3	15	105	5			1		3	7
Small		2	5	8							4
Very Small				2							
Cervidae		1									
Felidae											
Mustelidae											
Leporidae											
Sciuridae			1								
Geomyidae											
Bos/Bison				1							
Bos sp. and *B. taurus*											
Equus caballus											
Cervus canadensis				1						1	
Rangifer caribou											
Odocoileus sp.				3		1				2	
O. hemionus											
O. virginianus											
Ovis sp. and *O. aries*											2
Ursus sp.											
Canis sp.											12
C. lupus							1				
C. familiaris											
Lepus sp.											1
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined				2						2	1
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel										1	
Land Snail	1									1	
TOTAL	3	8	31	143	6	1	1	3	16	24	31

APPENDIX E

FAUNAL TABLES

by
Deborah L. Olson

This appendix provides information regarding the identified taxa recovered from some 75 sites (Table E-1) and the weights of individual faunal remains (Table E-2). It also includes descriptive information concerning the nature of cultural modifications observed on almost 40 bones (Table E-3). Descriptive information and interpretations concerning faunal materials are presented in Chapter 9.

Table D-47. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Incised Stone Tools (N=2).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
1054-200	Other	134.80	58.75	28.20	Nonflaked Lithic
1054-207	Other	180.00	81.40	63.40	Nonflaked Lithic

Some of the incisions are as short as 0.5 cm while others are as long as 3 cm. The incisions are much less pronounced than those on the other artifact in this class. The activity that produced these incisions remains undetermined.

possibly representing an early stage in the use and/or manufacture of an edge-ground cobble. One cobble (24LN1054-470) has the long axes heavily pecked and ground while the ends are more lightly pecked and ground. The final cobble in this class (24LN388-213) is the one end ground specimen.

Ground and Battered Face/Edge (N=6)

Four edge-ground cobbles bear evidence of battering on one face. One has battering on one end, and one (the fragmentary mudstone piece) has battering along several edges.

Face/Faces (N=7)

Artifacts are ground on at least one face and may also be ground on one or more edges (Table D-46). One artifact is in two large pieces. It is a mudstone metate, exhibiting a pecked and slightly ground oval depression on one face. The class also includes a fragmentary cylindrical sandstone abrader which is ground on all faces except the broken one. The remaining artifacts in this class, have been pecked and ground on one face, or ground on one face. One of the pecked and ground artifacts has been modified in three different places along the edge. This artifact also shows evidence of battering on one face. Two artifacts have been pecked on all edges and one shows battering on one face. The last two objects in this class are small fragmentary pieces of sandstone that are ground on one or more faces or facets. These may have functioned as abraders.

Most of the ground stone items are like those in the the edge ground cobble class of the LAURD collection (Roll and Smith 1982). However, at least six of those in this collection may be hand-held grinding stones, like those traditionally called manos.

Incised Stone Objects

This class of artifacts consists of two objects that exhibit incised lines on one or more surfaces (Table D-47). The incisions may be for decorative purposes or they may be the result of an activity such as the sharpening of a bone needle.

The most unusual item (24LN1054-207) is a large generally unmodified, cylinderical shaped, coarse grain, granitic river cobble. Incisions are confined to one end where they are fairly deep, straight, and cross-cut one another in a lattice-like pattern. The six incisions are short (1-2 cm length), thin and very obvious. They may have been formed by grinding, but the function of this artifact is undetermined.

The other artifact (24LN1054-200) is made on a broken, subrectangular, exfoliated piece of schist. One face has a series of irregular, straight to slightly curvilinear, thin, shallow incisions.

Table D-46. Metric (mm) and Material Type Attributes for Morpho/Techno Subcategory Ground Stone Lithic Tools, Classes: Face/Battered Edge (N=6), Face/Faces (N=7), and Edge/Edges (N=21).

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Face/Battered Edge					
189-3	Other	112.60	80.55	35.35	Grinding Tool
665-3	Quartzite	103.00	87.00	45.85	Grinding Tool
1052-1	Other	98.40	92.20	37.00	Grinding Tool
1055-5	Quartzite	107.60	97.70	43.00	Grinding Tool
1059-6	Other	122.90	90.40	50.00	Grinding Tool
1072-2	Other	100.00	77.55	47.40	Grinding Tool
Face/Faces					
364-16	Other	103.35	33.65	34.70	Grinding Tool
656-191	Other	110.30	99.40	58.40	Grinding Tool
656-202	Quartzite	118.15	103.40	56.90	Grinding Tool
696-1	Mudstone	241.50	160.00	54.95	Grinding Tool
1054-1384	Other	38.70	28.75	10.25	Grinding Tool
1058-345	Other	51.90	41.40	36.20	Grinding Tool
1073-28	Mudstone	210.50	77.35	41.00	Grinding Tool
Edge/Edges					
189-2	Other	95.75	78.30	42.35	Edge Ground Cobble
375-3	Other	120.05	80.10	41.45	Edge Ground Cobble
388-213	Quartzite	147.00	81.50	60.15	Edge Ground Cobble
417-70	Other	91.50	82.25	48.65	Edge Ground Cobble
686-5	Quartzite	127.20	105.90	70.00	Edge Ground Cobble
706-34	Other	89.45	78.45	50.90	Edge Ground Cobble
706-35	Other	117.80	102.00	52.40	Edge Ground Cobble
1052-2	Other	90.20	67.00	24.00	Edge Ground Cobble
1054-188	Other	73.55	51.60	37.70	Edge Ground Cobble
1054-277	Other	170.00	60.20	51.20	Edge Ground Cobble
1054-295	Other	140.80	87.25	44.20	Edge Ground Cobble
1054-470	Other	132.00	87.15	41.10	Edge Ground Cobble
1054-1255	Other	131.00	97.20	42.85	Edge Ground Cobble

Table D-46. (Continued)

Site/Cat. No. (24LN....-...)	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Morpho/ Functional Type
Edge/Edges					
1055-6	Other	110.60	77.20	37.60	Edge Ground Cobble
1056-4	Other	102.55	78.60	43.55	Edge Ground Cobble
1059-7	Other	108.15	83.50	52.05	Edge Ground Cobble
1060-22	Other	129.50	79.15	36.90	Edge Ground Cobble
1060-39	Other	105.80	85.40	39.35	Edge Ground Cobble
1062-1	Other	105.25	98.20	50.75	Edge Ground Cobble
1062-2	Other	101.55	58.70	25.60	Edge Ground Cobble
1080-1	Other	89.95	74.80	38.30	Edge Ground Cobble

Table E-2. (Continued)

Taxon	Site Number 24LN....										
	660	661	662	663	664	665	666	667	668	671	672
Unidentifiable		<.1					.7			.1	
Mammal											
Medium/Large		.1	.1				1.0				
Large	55.4	79.5		31.8	47.8	.9	170.6				
Medium		52.4	14.3	11.5	35.5		2.4			.3	
Small							.1				
Very Small											
Cervidae											
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison		17.1		152.8			137.0				150.9
Bos sp. and *B. taurus*	1720.2	166.0					55.2				128.1
Equus caballus								195.4			
Cervus canadensis									25.2		
Rangifer caribou											
Odocoileus sp.		66.4									
O. hemionus											
O. virginianus											
Ovis sp. and *O. aries*											
Ursus sp.											69.3
Canis sp.											
C. lupus											
C. familiaris											
Lepus sp.						4.1					
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined							<.1				
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel											
Land Snail							<.1				
TOTAL	1775.6	381.5	14.4	196.1	83.3	5.0	367.1	195.4	25.2	.4	348.3

Table E-2. (Continued)

Taxon	Site Number 24LN....										
	674	675	677	679	683	685	686	691	696	697	700
Unidentifiable		<.1	19.9	.3	<.1			.1	<.1		.1
Mammal											
Medium/Large		.2	66.6	7.6							
Large			25.9	13.5							
Medium			146.2	22.6	.4			.2			118.6
Small			1.5	.1	<.1						
Very Small											
Cervidae											
Felidae											
Mustelidae											
Leporidae											
Sciuridae											
Geomyidae											
Bos/Bison											
Bos sp. and *B. taurus*											
Equus caballus	96.5							615.2			
Cervus canadensis										226.2	
Rangifer caribou											29.7
Odocoileus sp.			1.7			24.7	83.2		89.7		
O. hemionus								74.7	103.4		
O. virginianus				12.9							
Ovis sp. and *O. aries*								48.9	39.2		53.9
Ursus sp.											
Canis sp.			97.3			10.2					
C. lupus											
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.											
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined								.1			
Catostomidae											
Salmonidae											
Bird and Turtle		4.4	<.1								
Mollusc											
Shell Undetermined and River Mussel			<.1								
Land Snail								<.1			
TOTAL	96.5	4.6	359.1	57.0	.5	34.9	83.2	739.2	232.3	226.2	202.3

Table E-2. (Continued)

Taxon	Site Number 24LN....										
	701	704	706	707	708	711	1054	1055	1058	1059	1060
Unidentifiable				.1	2.4	<.1	5.6	<.1	<.1		.2
Mammal											
Medium/Large				.1	4.5		8.6		.3	.8	
Large	91.2				91.2	1.2	33.4	.2	.3	15.9	.2
Medium	29.7			13.0	2.4	.2	49.8		1.1		.8
Small				1.6			3.9		<.1		<.1
Very Small						<.1	<.1		<.1		
Cervidae							.7				
Felidae							.1				
Mustelidae											
Leporidae							1.5				
Sciuridae											
Geomyidae											
Bos/Bison	10.4										
Bos sp. and B. taurus											
Equus caballus	22.3										
Cervus canadensis											
Rangifer caribou											
Odocoileus sp.						30.6		60.1			1.2
O. hemionus					115.2						
O. virginianus											
Ovis sp. and O. aries							86.7				
Ursus sp.											
Canis sp.									.2		
C. lupus							.4				
C. familiaris											
Lepus sp.											
Sylvilagus nuttalli											
Marmota sp.											
Sciurus sp.	.3										
Thomomys talpoides											
Onychomys leucogaster											
Fish											
Undetermined											
Catostomidae											
Salmonidae											
Bird and Turtle											
Mollusc											
Shell Undetermined and River Mussel		<.1	<.1				<.1				
Land Snail			.1			<.1	.1				
TOTAL	153.9	<.1	.1	14.8	215.7	32.1	190.8	60.3	2.0	16.7	2.4

Table E-2. (Continued)

Taxon	Site Number 24LN....								
	1064	1073	1074	1076	1086	1087	1097	1144	Across from 392
Unidentifiable	.2	.2	.3			2.8	<.1	.2	
Mammal									
Medium/Large		3.9	.1			.4		1.1	
Large		54.7	.2	2.4		.9			
Medium		68.3	3.4		.2	7.9	2.3	20.8	12.4
Small		.3	1.4			1.0		.3	
Very Small		<.1				<.1	<.1		
Cervidae						.4			
Felidae									
Mustelidae		1.3							
Leporidae		<.1	<.1			<.1			
Sciuridae									
Geomyidae								.2	
Bos/Bison						164.8			
Bos sp. and B. taurus		26.3							
Equus caballus				474.2					
Cervus canadensis		1186.6							
Rangifer caribou									
Odocoileus sp.		63.2							53.4
O. hemionus									
O. virginianus									
Ovis sp. and O. aries						55.2		40.7	48.2
Ursus sp.									
Canis sp.									
C. lupus									
C. familiaris								43.3	
Lepus sp.		5.3							
Sylvilagus nuttalli						.4			
Marmota sp.			2.5						
Sciurus sp.		.6							
Thomomys talpoides			.1					.1	
Onychomys leucogaster		<.1							
Fish									
Undetermined						.6	<.1		
Catostomidae									
Salmonidae									
Bird and Turtle		1.3	.4					.5	
Mollusc									
Shell Undetermined and River Mussel									
Land Snail							<.1		
TOTAL	.2	1412.1	8.4	476.6	.2	234.5	2.4	107.2	114.0

Table E-3. Summary of Bones and Bone Fragments with Cultural Modifications (i.e., Cutmarks and Sawing) and Descriptions of These Modifications.

Site	Taxon	Skeletal Element	Description
24LN366	Odocoileus sp.	Left Proximal metatarsal	Series of shallow, straight, parallel cutmarks on lateral side near impact area
24LN427	Odocoileus sp.	Right distal humerus	Sawed through condyle, then split
	Bos taurus	Right blade of illium	Sawed through illium shaft
	Unidentifiable	Cancellous fragment	Sawed
24LN488	Medium	Rib fragment	Short (2 mm), shallow cutmark in approximate center fragment on proximal face
24LN656	Odocoileus sp.	Distal metatarsal	A long (2.5 cm), shallow cutmark in the anterior groove
			A tight cluster of about 6 shallow (scratch-like) cutmarks on the proximal end of fragment
	Odocoileus sp.	Last rib	Group of 6 parallel cutmarks (about 5 mm in length) on distal end
	Medium	Rib fragment	A tight cluster of 3 short (2 mm), shallow, parallel cutmarks toward proximal end
	Medium	Tibia Shaft fragment	3 short cutmarks roughly aligned parallel to the long axis of the fragment
24LN661	Bos sp.	Left malar and lacrimal	A series of straight, shallow (scratch-like) cutmarks that crisscross
	Odocoileus sp.	Left distal tibia	Deep cutmark (1.3 cm long) on medial side immediately below the break
			A cutmark (5 mm long) on the lateral posterior face

Table E-3. (Continued)

Site	Taxon	Skeletal Element	Description
24LN661	Large	Rib fragment	A cutmark near the distal break
	Large	Long bone shaft fragment	2 short cutmarks that appear new (i.e., recent)
	Large	Metapodial shaft fragment	A cut mark on posterior face near the groove, cut with a sharp knife (metal?)
	Medium	Numerous shaft fragment	A cut mark made by possible metal knife
	Medium	Tibia shaft fragment	A recent looking cut mark (1 cm long)
24LN663	*Bos* sp.	Distal metacarpal	Sawed
24LN664	Large	Rib fragment	Sawed on both ends
	Medium	Left proximal femur	An immature individual, sawed diagonally on shaft
24LN666	Large	Thoracic vertebra spine	2 parallel grooves consisting of several cuts separated by 9 mm on the side of the spine, the lower is 10 mm, the upper is 14 mm
	Large	Lumbar vertebra spine	2 notches in anterior face of spine, bottom one is larger than top
	Large	Rib fragment	At one end, cut part-way through and slightly polished, part broken
	Large	Distal metatarsal shaft	2 cut marks on anterior face on either side of groove
24LN679	Small	Longbone shaft fragment	A cluster of 4 shallow cutmarks (about 5 mm in length) roughly aligned lengthwise with the fragment
	Medium	Longbone shaft fragment	A series of very short cutmarks along the break

Table E-3. (Continued)

Site	Taxon	Skeletal Element	Description
24LN679	Medium	Longbone shaft fragment	A cutmark (2 mm long) roughly aligned lengthwise with the fragment
24LN691	*Odocoileus* sp.	Right distal femur	A cutmark (2 cm long) on the medial side above the trochlea
24LN701	Medium	Tibia shaft fragment	Sawed and cutmarks
24LN708	Large	Longbone Shaft fragment	Sawed
24LN1054	Cervidae	Antler fragment	Cutmark near break, also burned
	Large	Longbone shaft fragment	4 short, shallow, parallel cutmarks
	Medium	Longbone shaft fragment	3 more or less parallel cutmarks aligned lengthwise
	Medium	Longbone shaft fragment	2 very short, parallel cutmarks, roughly aligned lengthwise with the fragment
	Medium	Longbone shaft fragment	2 short, parallel cutmarks over 2 longer parallel cutmarks, both sets of cutmarks are aligned lengthwise with the fragment
24LN1055	*Odocoileus* sp.	Left innominate	Cutmarks are within the acetabulum as in disarticulating the hindlimb
24LN1144	Medium	Longbone shaft fragment	A short cutmark (6 mm) with a fairly wide crosssection perpendicular to length of fragment
	Medium	Longbone shaft fragment	A cluster of short (2 mm), shallow, parallel cutmarks along the break

APPENDIX F

HISTORIC ARTIFACTS

by
Deborah L. Olson and Marilyn Bailey

The historic artifacts collected from 32 sites and isolated finds are categorized by material type (i.e., metal, ceramic, glass, and other). The categories are further subdivided: metal by function, ceramic by fired-material type, glass by function and color, and other by function and material type. This classification scheme follows that of Thoms et al. (1981). Table F-1 presents a site by site tabulation of the artifacts by category. Constituent artifacts are described in the following section. The last section is a discussion of special types of time diagnostic artifacts.

Descriptive Data

Metal Category

Metal artifacts are subdivided by function into 13 classes: common household items, cans, fencing material, farm/ranch equipment, square nails, round nails, miscellaneous construction items, cartridges, bullets, coins, rivets and rivet buttons, miscellaneous personal items, and unknown/unidentified fragments. The 14 common household items are those associated with activities occurring in and around the house. They include stove parts, sewing machine parts, lamp parts, clock parts, a knife blade, and trunk latch. The single, rusty knife blade from 24LN369 is 10 7/8 inches long. There are three holes in one end for handle attachment. The trunk latch from 24LN701 is fragmentary and rusted. The clock parts include a small, circular item which could be a fly wheel (24LN1144), and an alarm clock back, 4 1/8 inches in diameter with print clearly legible (24LN521). The stove fragment (i.e., corner of outer shell) is from 24LN521 and has a scroll design with a cluster of three leaves in the center. The three sewing machine parts are from 24LN521 and represent one machine. The parts are fragments of the frame with some black paint still visible. The brace has the following letters 1884.MAR.17:1885, which could represent a manufacture or patent date. Six lamp parts are from two sites--24LN521 (1) and 24LN687 (5)--and consist of the metal neck, screw, wick holder, and mantle holders. The five parts from 24LN687 represent two lamps.

The cans and can fragments (including mason jar lids and a wire handle) are also household items. The wire handle from 24LN657 is like those on lard cans. The two mason jar lids from 24LN701 and 24LN705 are bothmetal screw top lids. Another one from 24LN701 has an intact ceramic interior. Most (13) of the cans and can fragments are the "Hole-in-Top" variety which are characterized by a large hole for filling. This variety was first manufactured in 1810 and was used as late as the 1920s. Machine made seams came into being after 1880.

Table F-1. Site by Site Tabulation of the Historic Artifacts.

Catagory	Site Number 24LN....																			
	366	368	369	382	386	388	390	401	419	423	429	443	447	521	656	657	661	672	674	682
Metal																				
Common Household Item			1											6						
Cans and Can Fragments	1													4		1				
Fencing Material																1			1	
Farm/Ranch Equipment	1																			
Square Nails														2						
Round Nails							2							11		2				
Miscellaneous Construction Equipment				8										4						
Cartridges		1	3		1	1								2	1					
Bullets					1				1	1										
Coins																				
Rivets and Rivet Buttons																				
Miscellaneous Personal Items														1						
Unknown Items and Unidentified Metal Fragments	1									1										
Ceramic																				
Stoneware																				
Earthenware							9	2						4			2			3
Porcelain							3	1						2		3				1
Glass																				
Clear Windowpane														88						
Container																				
Clear	2						2			1								4		
Aquamarine	1						5	1						5		1				
Green	1							1						3						
Purple							5						1	4		1				
Amber													1	7		2				
Other Items	3	1							1				2	2		2				
Other																				
Button: Shell, Plastic, Other		1												3						
Beads/Copper											4	1								
Miscellaneous																1				
Site Totals	10	3	4	8	2	1	26	5	2	3	4	1	4	148	1	14	2	4	1	4

Table F-1. Continued

Catagory	Site Number 24LN....														
	687	690	701	704	705	715	1054	1073	1087	1092	1093	1097	1144	Isolated Finds	Item Totals
Metal															
Common Household Item	5		1										1		14
Cans and Can Fragments	1		6		8										21
Fencing Material			3												5
Farm/Ranch Equipment			14												15
Square Nails			2										5		9
Round Nails			139	1									3		158
Miscellaneous Construction Equipment			11		1										24
Cartridges	2		3		5								1		20
Bullets	1								1			2			7
Coins	1												1		2
Rivets and Rivet Buttons			5		1								1		7
Miscellaneous Personal Items			3							1					5
Unknown Items and Unidentified Metal Fragments			2										3		7
Ceramic															
Stoneware	1		4												5
Earthenware			2		2								1		25
Porcelain			1		1										12
Glass															
Clear Windowpane			59										7		154
Container															
Clear		1	4		2									1	17
Aquamarine			11		12	1							1	1	39
Green			3												8
Purple					6			2			1		1		21
Amber			6												16
Other Items					6										18
Other															
Button: Shell, Plastic, Other	1				2										7
Beads/Copper							1								6
Miscellaneous				1		1									3
Site Totals	12	1	279	2	46	2	1	2	1	1	1	2	25	2	624

These 13 cans all post date 1880 and are from four sites (24LN521 [1], 24LN687 [1], 24LN701 [5], and 24LN705 [6]). The remaining four can fragments represent a variety of types. A small, open-top spice can, with most writing obscured, came from 24LN705. A can lid from Pecot Baking Powder, a can lid with a center screw cap, and a rolled can lid with the wire key in place were collected from 24LN521. The rolled can lid type was first manufactured in 1862.

Fencing material includes barbed wire and fencing staples. The barbed wire from 24LN674 is about 12 inches long and the piece from 24LN657 is about 10 inches long. Both are the double strand barbed wire variety in common use at the present time. Three fencing staples came from 24LN701.

Farm/ranch equipment in the collection includes a mower blade fragment, a large bolt, a spring snap, a file, a horseshoe nail, a car part, and wire cable. All but the car part (24LN366) were collected from 24LN701. The car part consists of a cap, possibly a gas cap. The large bolt (4 1/4 inch) is the type commonly associated with farm machinery. The single tooth from a mower blade, the triangular metal file (5 3/4 inches long) a standard size horseshoe nail, and part of a spring snap (the kind used on dog-leashes) are very rusted. A coil of 5 strand cable, 4 inches in length with 3 pieces of single strand wire encrusted around it and 7 pieces of differing lengths and weights also were collected.

Nails were divided on the basis of morphology into square and round. The square nail type was commonly used during the late 1800s and early 1900s. Round nails, also called wire nails, became common in the 1920s. Nine square nails were recovered from three sites, 24LN521 (2), 24LN701 (2), and 24LN1144 (5). The wire or round nails vary in size from 40d to 2d, but most (98 of 158) are 10d and 8d. Their condition varies from good to very rusty and twisted.

Miscellaneous construction items include nails and other items used in the construction of buildings, railroads, etc. These items are a door hinge, metal spikes, a screw, a fragment of screen, washers, tacks, and an axe head and wedge. The door hinge from 24LN705 is ornate and has 6 screw holes. It is bent but still retains some black paint on the surface. The large screw fragment, fragment of window screen, four small (1/2 inch) washers, three carpet tacks, and a metal spike all were collected from 24LN701. A very rusty, double bit axe head with the remains of the wooden handle still present was also collected from 24LN701. Three carpet tacks and a possible finishing nail came from 24LN521. Seven large metal spikes 1/2 inch and 3/4 inch in diameter were collected from 24LN382 and were used in construction of a logging flume. A metal blade, probably some kind of wedge, also was collected from 24LN382. This artifact is 6 1/2 by 3 1/4 inches at the widest point of the blade. There is a 1/4 inch hole on one side of the blade near the head with a piece of wire twisted through it and grooves on both sides.

The cartridges are either rimfire (mostly 22 caliber) or centerfire (various calibers) types. These can be typed and dated with some accuracy by headstamps and are discussed under time diagnostic artifacts. The bullets include four spent lead slugs, one (3/10 inch diameter bullet) from 24LN423 and 2 buckshot bullets from 24LN1097. The lead slugs appear to be from 22 caliber cartridges in three cases, 24LN687, 24LN419, and 24LN1087. The lead slug from 24LN386 is a 44 caliber.

The two coins from 24LN687 and 24LN1144 are discussed in the time diagnostic artifacts section.

Seven metal rivets and rivet buttons were collected from three sites. These items are the type found on clothing (i.e., jeans or work clothes). The rivet from 24LN705 is 3/8 inch in diameter and is made of brass; a piece of denim-like material is still attached to the rivet. The remaining six rivets and rivet-style buttons (i.e., jean pockets) were collected from 24LN701 (5) and 24LN1144 (1).

The miscellaneous personal item category includes those items that are related to clothing (i.e., belt buckle, an overshoe fastener, a fabric grip, a safety pin and a garter pin), with the exception of the rivets. The very rusted and broken belt buckle, a portion of an overshoe fastener and the fabric grip were collected from 24LN701. The fabric grip is similar to slides used on undergarments to adjust strap height (8/10 of an inch wide). The head and part of the shaft of a medium size safety pin came from 24LN521. A safety pin with a specially designed head and a clothing slide on the stationary part of the pin was collected from 24LN1092. The pin could be used in place of a garter belt and retains a clearly legible patent date, PAT. JUNE 23, 1885.

Seven metal items of unknown function were collected from four sites. A flat metal strip 3 x 3/4 x 1/4 inch with a tiny hole in each end and a heavy wire (3 inches long with a loop on one end and a small hook on the other) came from 24LN701. Two small metal fragments and a thin wire (roughly shaped like a safety pin) were collected from 24LN1144. Two small, irregular-shaped soft metal fragments that resemble solder came from 24LN423 and 24LN366.

Ceramic Category

The ceramic category is divided into three types: stoneware, earthenware, and porcelain. Stoneware has been further divided on the basis of exterior finish: alkaline-glaze exterior (24LN687 [1] and 24LN701 [2]) and salt-glaze exterior (24LN701 [2]). A rim sherd of a large jar or crock that is light tan in color with a blue and brown design on the outer surface was collected from 24LN687. Two rim fragments of a large crock came from 24LN701. Two fragments--a base and about one inch of the body and a shoulder--representing two ale bottles, were collected from 24LN701. The two fragments were determined to be from separate bottles based on thickness, slip and paste density. Ale from Scotland (the William Younger Co. and the William McEwan Co., both of Edinburgh) was bottled in salt-glaze containers beginning in 1805 and by the 1850s had reached the west (Wilson 1981:7-8).

Earthenware items are all of the ironstone variety. Several bear maker's marks of varying completeness, but none have been identified. In all cases (25), the glaze is white with various degrees of crazing. The nine fragments from 24LN390 represent at least two different bowls, a large wash bowl with a slightly scalloped rim, and a small, deep bowl. None of the fragments have maker's marks, but all appear to have been burned. Two items are represented from 24LN401. Five fragments fit together to form the rim and body of a saucer with a fragment of the maker's mark intact. The other item is a small irregular shaped fragment with an almost complete maker's mark. Two sherds, 1/4 inch thick from an unknown vessel with a portion of the maker's mark intact, a rim sherd 1 3/4 inch thick (with a stamped design of brown leaves and stems on the interior surface), and a large fragment of a saucer were collected from 24LN521. The saucer fragments are stamped with a crown, geometric and scroll design on the interior rim and a flower and stem design of brown flowers highlighted with blue and red centers in the center. A portion of the maker's mark is intact; the fragment appears to have been burned (i.e., "pot lid spalls"). Two rim sherds that fit together were collected from 24LN661. This fragment is like one described previously (saucer from 24LN521). A rim sherd from a bowl or cup and a thick basal fragment with part of the maker's mark came from 24LN701. A large bowl fragment (with part of the base) and a rim and base portion of a shallow bowl came from 24LN705. The shallow bowl fragment has most of the maker's mark and fits together with the saucer fragment from 24LN401, a nearby site. The other bowl fragment has a slightly scalloped rim, a faint scroll design molded on the edge of the rim and the maker's mark, about half complete. Four fragments from undetermined vessel types were collected from 24LN682 (3) and 24LN1144 (1).

Twelve porcelain artifacts were recovered from seven sites. A small rim sherd of thin fine china, with a sinous rim and a dark green design outlined in gold, and a body sherd, with a delicate leaf and stem design in shades of green and brown on the inner surface, came from 24LN521. Thirteen fragments were reconstructed into a fragment of painted china from 24LN401. The painting depicts a portion of a white house with a red roof and shrubs in the foreground; a quail-like bird is in the shrubs. A white rim sherd of a bowl with a sinous edge and a series of raised dots on the inner surface was collected from 24LN682. Half the base of a bowl of molded design with a stamped floral design came from 24LN705. The flowers are red with green leaves on a background of white with blue highlights. A small body sherd of a cup, a tiny basal fragment with part of the maker's mark (the letters are cobalt blue on white; interior surface cobalt blue), and a base fragment of a large plate or bowl with a white exterior and a light blue interior with a flower and leaf design in pink and shades of blue) came from 24LN657. A small glossy white sherd of unknown type was recovered from 24LN701 and three white fragments came from 24LN390. One of these fragments is a slightly scalloped rim that is "potlidded." Another fragment is a rim and body of a cup with a delicate green fern-like design stamped on the exterior surface. None of these have maker's marks.

Glass Category

The glass artifacts are divided by function into window pane, container (which is further divided by color), and other. The window pane glass was collected from three sites. All the window glass from 24LN521 is scratched and patinated. The 59 fragments from 24LN701 and 24LN1144 are also scratched and patinated, but not as heavily as those from 24LN512.

The bottle or container class is divided by color: clear, aquamarine, green, purple, and amber. The 16 clear bottle fragments were collected from seven sites. The complete, small, clear, battery oil bottle is an isolated find. The lettering on the bottle reads "SPECIAL BATTERY OIL, THOMAS A. EDISON, INCORPORATED, PRIMARY BATTERY DIVISION, BLOOMFIELD, N.J., U.S.A." and the reverse side bears a patented trademark. Two fragments (one a faceted curve) of bottles were collected from 24LN366. A very small bottle fragment, the rim and neck portion of a fairly large bottle, and two medium size fragments of a jar or container (discolored by fire) came from 24LN390. A small, undetermined fragment was collected from 24LN423. A small fragment of a bottle with one edge raised and part of an embossed character still visible came from 24LN690. Four fragments, probably from a recent catsup bottle, were collected from 24LN672. One fragmentary and two complete necks of the stopper type bottle (either medicine or toiletry) and the partial base of a large bottle came from 24LN701. The neck and mouth of a large wine or champagne bottle (with a fragment of the foil/lead seal still around the mouth), and a neck and shoulder of a small, square medicine bottle (with an asymmetrical mouth) came from 24LN705.

A total of 39 aquamarine bottle fragments, including an isolated find, was collected. The isolated find is a portion of the neck and rim of a bottle with a cylindrical-collar lip finish and a scratched and patinated surface. A shoulder fragment of a small bottle from 24LN657, a slightly curved fragment from 24LN1144, a base and part of the side of a small bottle from 24LN715, a large very thick, irregularly shaped fragment with a slight patina from 24LN306 have no identifying marks. Three, thin, slightly curved fragments with a roughly pitted exterior and a fairly large body fragment (with a small broad edge from a heavy jar or continer) came from 24LN390. The side panel fragment of a medicine bottle with embossed letters "OIL IOWA" from 24LN401 has a very slight aquamarine tint. Six, thick jar fragments without maker's marks, a tiny rim fragment with embossed letters, two body fragments of a Ball mason jar, the base and part of the side of a large bottle with scratches and patina, and the neck, sloping collar and part of the shoulder of a small medicine or toiletry bottle came from 24LN701.

Five aquamarine fragments were recovered from 24LN521. These include the base and a portion of the side of a jar with maker's mark, the base of a small rectangular bottle with heavy patina and maker's mark in embossed letters (of a type introduced in 1861), a large, round, medicine bottle fragment with a flanged-lip neck and part of the shoulder with heavy weathering, and two square fragments from the same

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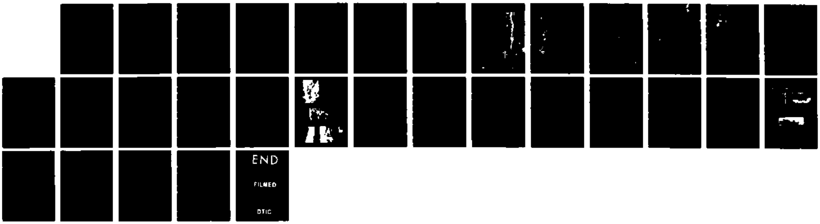

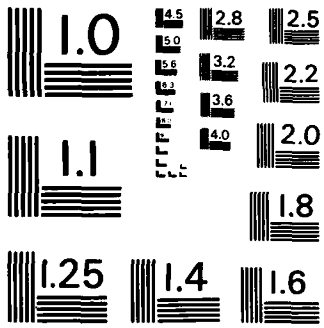

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

bottle with embossing on the side and part of a maker's mark on the base.

Twelve bottle fragments were collected from 24LN705. Eight are medicine bottles, three are mason jar and one is a thick fragment of irregular shape with a large "27" crudely embossed on the flat surface. The mason jar fragments include the top one-third of a jar, and two base fragments with embossed maker's marks. Two fragments fit together to form the neck, shoulder and side of a small medicine bottle with a double rounded-collar neck finish with "Dr. S. Pitcher's" on the side. Dr. S. Pitcher's is a patent medicine and the bottle probably would have Castoria printed on the other side. These bottles were common from 1865-1890 (Wilson 1981:49). An advertisement in The Evening Express, Los Angeles, 1881 reads "Pitcher's Castoria is not narcotic. Childrens grow fat upon, mothers like, and physicians recommend Castoria. It regulates the bowels, cures wind colic, allays feverishness and destroys worms" (Wilson 1981:41). Two fragments, a neck/collar and a base, are probably from the same type of bottle. A collar, neck and shoulder fragment from a small medicine bottle with no maker's marks was collected from 24LN705, as was a medicine bottle fragment embossed: "Dr. Shoop's Family."

Eight bottle fragments of green glass were collected from four sites. A single fragment with no maker's mark was collected from 24LN366. The neck, collar and lip of a large wine bottle with a heavy patina came from 24LN401. The narrow band-collar is 1/4 inch lower than the lip; this was the standard style for turn-of-the-century wine bottles. Two heavily patinated and scratched fragments and part of a bottle neck (with an intact collar and lip and a series of grooves and irregularities on both interior and exterior surfaces) came from 24LN521. A basal and side fragment of a large bottle and two tiny body fragments were collected from 24LN701.

A total of 21 bottle/jar fragments of purple glass was collected from eight sites. A tiny, heavily scratched fragment from 24LN447, and three irregular shaped, slightly curved fragments from 24LN390 have no maker's marks. The base of a 1/2 gallon Mason jar from 24LN390 has a maker's mark. A rim fragment of a jar or container with a smooth, 1/4 inch wide collar (with small inset lip) and a curved side fragment of a small bottle, from 24LN657, are heavily scratched and patinated. A neck/rim fragment from a short necked medicine bottle was collected from 24LN1093. An almost complete jar base with a maker's mark ("M"), a jar base fragment with maker's mark ("KING CO., 90SS, PAT. FEB 10 03"), a base/side fragment of an oval bottle with patina, and a small thick fragment with heavy patina and partial maker's mark came from 24LN521.

Eight bottle fragments were recovered from 24LN705. These include a rim fragment of a thick glass jar with a smooth collar that flairs slightly outward toward the base, a small base/side fragment from a medium size bottle with part of maker's mark ("TED 898"), and four medicine bottle fragments. Two medicine bottle fragment bases bear maker's marks and one (mark "KELLOGG") is scratched and patinated. The other maker's mark is "M.D. CO." The collar/lip/neck/small shoulder

fragment is from a medicine or small whiskey bottle. The remaining fragment is the flanged lip, neck and part of shoulder from a small medicine bottle.

Sixteen amber bottle glass fragments were collected from four sites; a tiny fragment from 24LN447 is unidentified. The 1/2 bottle top with a ring and sloped collar and a body fragment with scratches and patina (from 24LN657) are from whiskey bottles. The collar and neck fragment of a patinated whiskey bottle, a complete base of a very scratched and patinated bottle with maker's mark "R + CO. 6," two base/side fragments of large bottles and two small body fragments with heavy patina came from 24LN701. Four collar/neck fragments (one recent and three patinated) and three body fragments were collected from 24LN521.

The 18 other glass items include two unidentified, clear glass fragments from 24LN657, two tiny, thin, clear glass fragments from 24LN447, a small lump of melted and fractured glass from 24LN419, an irregular shaped, flat, heavy, clear glass fragment (like an automobile headlight) from 24LN705, a bottle stopper from 24LN368, a blue and white translucent marble with a few scratches and pock marks from 24LN366, as well as two drinking glass fragments, three decorative items, and four lamp mantle fragments from other sites. Two large, clear glass fragments from 24LN366 are possibly from a decorative jar. A rim fragment with three scallops (from an oil lamp mantle) and the indented base of a drinking glass from 24LN521 are made of purple glass. The three fragments with scalloped rims from lamp mantles, a small rim fragment from a smooth lightweight drinking glass (with a raised, irregular shaped, point design in cream color on the exterior surface), and a thick, flat, fragment of a cut or pressed glass bowl or vase from 24LN705 are all purple glass.

Other Category

This category has been divided by function and material into buttons (shell, plastic, other), trade goods (beads and copper) and a miscellaneous class. The three items in the miscellaneous class include a small yellowish, transparent plastic fragment from 24LN704, a tiny curved clay fragment from possibly a pipe from 24LN715, and a weathered and broken brick (with a rectangular identation on one side and mold marks from manufacture on the other) are from 24LN657.

Seven buttons of various materials and exhibiting different morphologies were collected from four sites. A very weathered (chalky texture), small shell button with two holes came from 24LN687. A small, weathered, four hole utilitarian shell button (chalky texture) with some iridescence was recovered from 24LN368. A small, white, four hole, shell button with some weathered spots and a small, white, plastic button with four holes were collected from 24LN705. A small, four hole, shell button which lacks iridescence, a small, two hole, shell button with some iridescence on unweathered surfaces (i.e., shank area and back which has a series of small natural ridges) and a black, one half inch,

two hole button (of unknown material), with a series of small lines across the face leaving a small, smooth, outer ring, came from 24LN521. The two shell buttons post date 1900.

The remaining items in this category are considered to be trade items and include beads and copper. These items are classed as historic aboriginal. The copper fragment from 24LN1054 is small (2.5 cm long by 1.5 cm wide) and flat with with a groove along one side. This item was recovered from a test pit between 30 to 40 cm below surface. The translucent, blue, glass bead from 24LN443 is 5 mm in diameter, pitted and scratched and slightly irregular in shape. This bead is similar to another bead from Kootenai Flats identified as "Canton wound late 1700s-1860s, introduction period" (D. Chance, personal communication: 1982), except that it is smaller and translucent. Four tiny seed beads (sky blue, navy blue, royal blue and pink) were collected from 24LN429.

Time Diagnostic Artifacts

Time diagnostic artifacts are those items that can be used to establish the earliest possible occupation or use of the site. Several items have been discussed in the descriptive section, but the most useful ones (i.e., coins and cartridges) are discussed in greater detail here. Items previously described are only summarized.

Coins

Two coins were collected, a 1919 penny from 24LN1144 and a liberty head quarter 1902 from 24LN687. The penny is discolored but in good condition. The liberty head quarter, with 13 stars on one side and an eagle on the other, is in good condition but is somewhat blackened by exposure or burning. Coins are very deceptive when using them to establish earliest possible occupation, because they often are curated and can stay in circulation for extremely long periods.

Cartridges

Cartridges can be typed easily using the headstamps (also called basestamp). To a certain extent headstamps and cartridges are time diagnostic. The four rim fire cartridges are all 22 caliber and probably of recent origin. The two from 24LN369 are in good condition; one has a "C" and the other "H" as headstamps. The cartridge from 24LN687 has an "H" as headstamp and is in good condition. The remaining rim fire cartridge from 24LN1144 also has an "H" as headstamp. The three metal caps from shotgun shells are probably recent. The one from 24LN701 bears the following headstamp: "WINCHESTER REPEATER NO 12." One of the two metal caps from 24LN705 still has all the paper wadding in place; both have the same headstamp: "UMC CO, NEW CLUB NO. 10."

The remaining 13 cartridges are all the center fire variety of varying calibers and headstamps. Eight have "WRA CO." as headstamp which stands for the Winchester Repeating Arms Company. "WRA Co." was replaced by "WRA" in the 1930s (Bearse 1966:55). Three are "U.M.C." which represents Union Metallic Cartridge Company of Bridgeport, Connecticut, begun in the late 1870s and used until 1911 when the company merged with Remington Arms Co. (Bearse 1966:55). The resulting headstamp, "REM-UMC" was represented by a single cartridge. The last headstamp is "D. C. CO." which stands for the Dominion Cartridge Co., Brownsbury, Quebec, in use until 1948 (Bearse 1966:44).

Two cartridges have a "WRA CO. 33 W.C.F." headstamp. The one from 24LN369 is in good condition; the one from 24LN386 is weathered and cracked. This cartridge was introduced in 1895 for the Winchester Model 1894 lever action rifle and is still in production (Datig 1956:136). These cartridges date between 1895 and 1930.

The cartridge from 24LN368 with headstamp "WRA CO. 33 W.C.F." is slightly bent and cracked. This cartridge was introduced in 1902 and was developed especially for Winchester Model 1886 lever action rifle (Datig 1956:142). This cartridge was discontinued in 1935 (Bearse 1966:126).

The weathered cartridge from 24LN388 ("WRA CO. 32 W.C.F.") is the type introduced in 1906 for the Winchester self-loading rifle model 1903, and is still in production (Datig 1956:140). A cartridge from 24LN701 with headstamp "WRA CO. 32 G.T.W." is in good condition and dates from the same time. So too does the cartridge from 24LN705 with headstamp "WRA CO. 32 H.P." This cartridge is jammed into another and both are bent and broken. The other cartridge bears headstamp "UMC. 32-40 H.P." Another cartridge from 24LN701 with headstamp "UMC 32-20" is flattened and broken.

A cartridge from 24LN656 with headstamp "WRA CO. 45-70 USC" is the largest in this collection. It is weathered, bent and has three splits. This cartridge was introduced in 1873 and is still in use in South America. This cartridge dates after 1876 when brass was used (Bearse 1966:155-156).

The cartridge from 24LN687 with headstamp "REM-UMC 30-30" is crushed and broken in the crimped area. This caliber was introduced in 1906 (Bearse 1966:98), but the cartridge dates after 1911 when Remington and Union merged and UMC was added to Remington's headstamp.

Two large caliber cartridges came from 24LN521. One with headstamp "WRA 40-82 WCF" is bent and broken. This cartridge was introduced in 1885 for the 1885 model single shot which was the preferred weapon of Yukon miners (Datig 1956:156; Bearse 1966:148). The other cartridge with headstamp "DC CO. 44-40" is in good condition. The 44-40 cartridge was introduced in 1873 for the US Government. This is the oldest centerfire rifle cartridge in the United States and was developed for the 1873 model, "The Gun that Won the West" (Bearse 1966:153-154). This type is still in production.

Other Time Diagnostics

Several other items previously described can also be used as time markers. The "Hole-in-Top" cans from 24LN521, 24LN687, 24LN701, and 24LN705 were first made in 1810 but became common when machine made after 1880. They were discontinued in the 1920s. The roll type, banded with a key, (from 24LN521) were first manufactured in 1862 but are still in common use. Square nails were common in construction from the late 1800s to the early 1900s. Salt-glaze stoneware ale bottles have been present in the west since the 1850s. Dr. Pitcher's patent medicine bottles are common from 1865 to 1890 (24LN705). And finally, three items have patent marks: a sewing machine brace from 24LN521 (March 17, 1885), a bottle fragment from 24LN521 (February 10, [19]03), and a garter pin from 24LN1092 (June 23, 1885).

APPENDIX G

DESCRIPTIONS OF LATE PLEISTOCENE AND HOLOCENE DEPOSITS

by
Robert R. Mierendorf and Bruce D. Cochran

Late Pleistocene and Holocene deposits mapped in the project area unconformably overlie Precambrian metasediments (Gibson 1948). These deposits record a range of depositional conditions reflecting climatic and environmental changes during the last 24,000 years or more. This section describes the major rock stratigraphic units and their geomorphic expression within and immediately adjacent to the project boundaries. Descriptions are compiled from key measured sections exposed within the drawdown zone of Libby Reservoir. US Geological Survey 7.5 minute topographic maps constituted the field base maps. In addition, black and white, low elevation aerial photographs supplied by the Seattle ACOE allowed photogeologic correction. Not all portions of the mapped area were examined with equal intensity and the integrity of stratigraphic sections varied considerably due to modification by shoreline processes and hillslope erosion within the devegetated drawdown zone. As a result, Figure 7-4 (a fold-in map) is considered a reconnaissance level map. Figure 7-5 shows the approximate stratigraphic relationship of mapping units and landforms along three transects within the project area.

Mapping Units

Weakly Stratified Drift (Qt_1)

Description

Poorly-sorted, nonstratified to weakly stratified, subangular to subrounded gravels and boulders of varying lithologies form the oldest late Quaternary deposit in this portion of the middle Kootenai River valley. The gravels are supported in a light gray, sandy silt matrix. Over 70 percent of the gravels and boulders are striated or grooved; facets are well developed. Thickness varies from a few meters to well over 25 m.

Distribution and Expression

Geomorphically, these deposits, between Eureka and the United States-Canada border, are expressed as drumlins with longitudinal axes trending south and southeast (Clague 1975a, 1975b; Johns 1970). Although numerous drumlinized forms have been noted in adjacent valleys and in the Libby Creek drainage south of Libby, Montana (Alden 1948, 1953), drumlins within the project area are confined to the Tobacco Plains zone, north of the mouth of Tobacco River. Basal till deposits, however, occur at many localities between Libby Dam and the International Boundary and can be seen in numerous road cuts along SR 37

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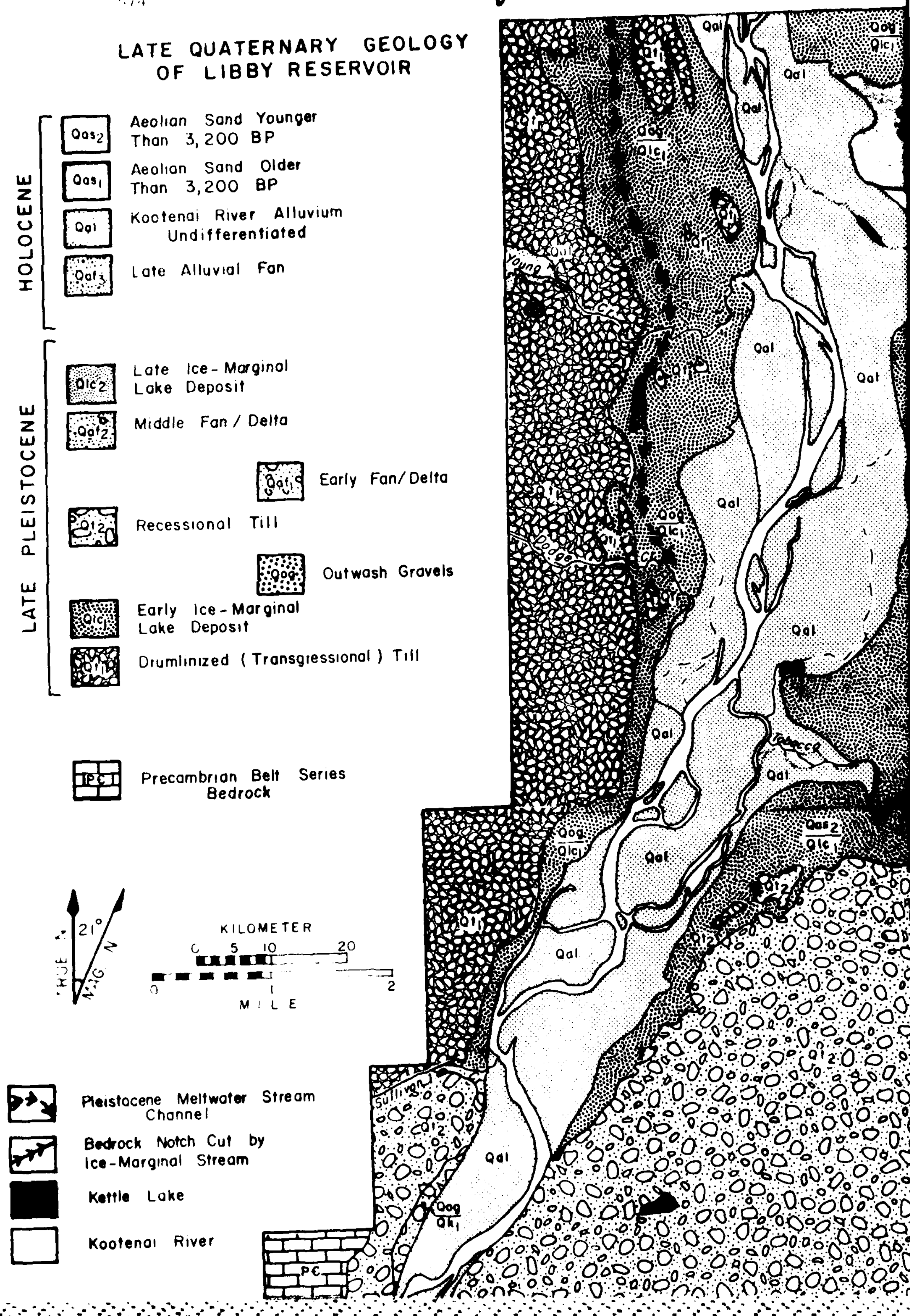
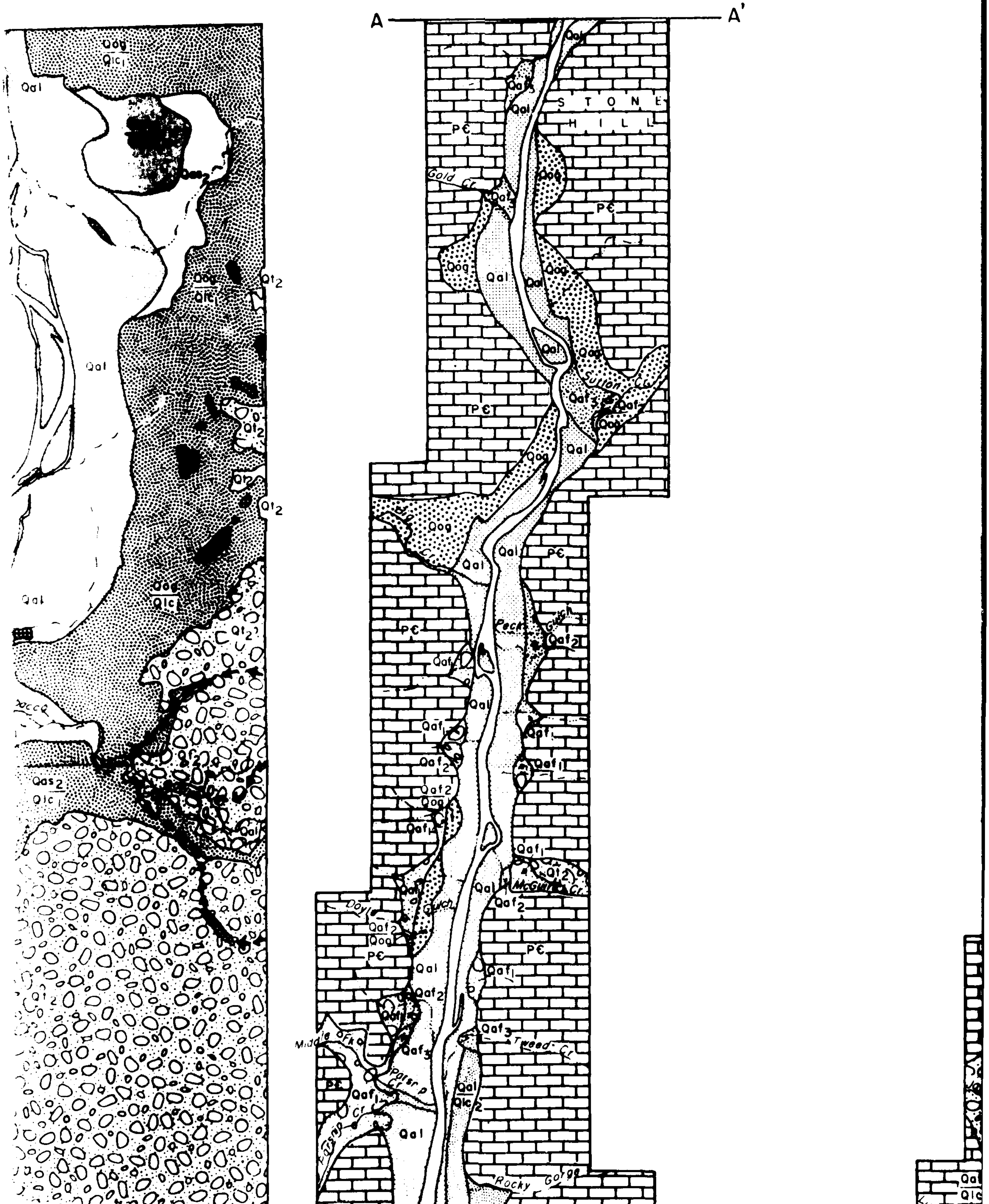
LATE QUATERNARY GEOLOGY OF LIBBY RESERVOIR



2 of 6


A
A'
STONE HILL
Gold Cr.
Sutton Cr.
Peck Gulch
McGuire Cr.
Doyle Gulch
Middle Fk.
Parsnip Cr.
Tweed Cr.
Rocky Gorge
Qal
Qog
Qaf
PЄ
Qt2
Qlc

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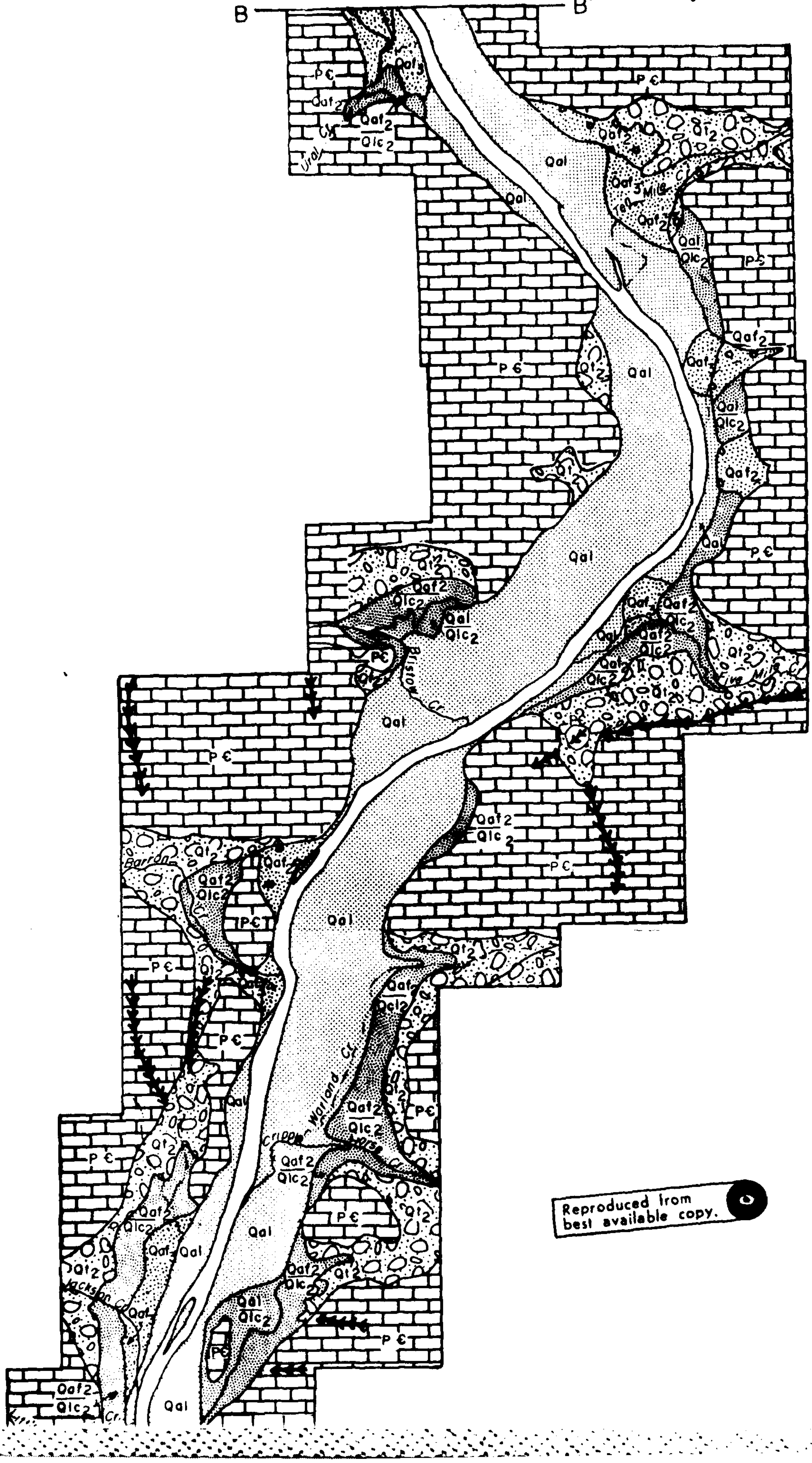
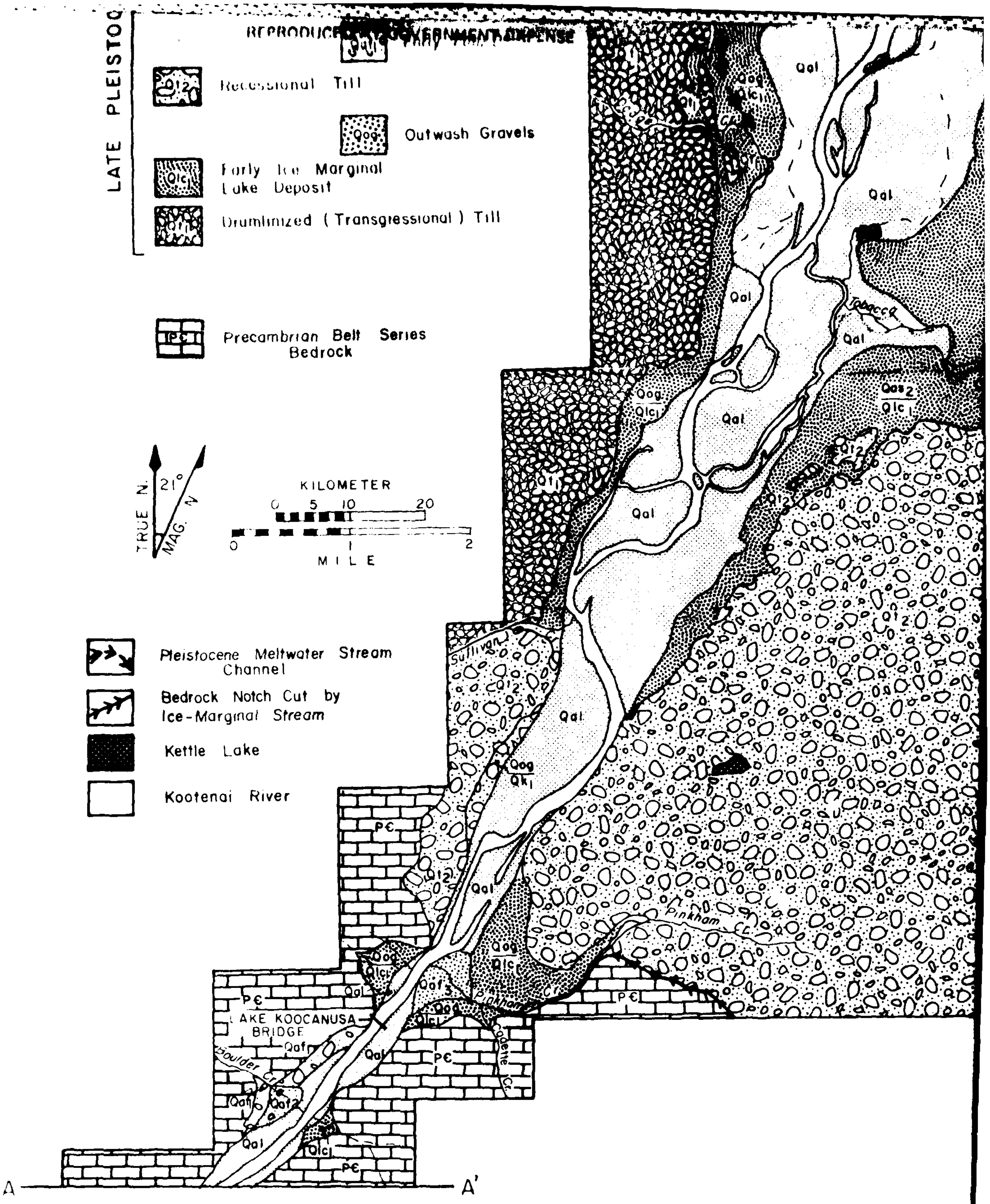

B
B'
PЄ
Qal
Qaf2/Qlc2
Qt2
Qal/Qlc2
Five Mile Cr.
Bristow Cr.
Barron Cr.
Warland Cr.
Cripple Cr.
Jackson Cr.
Ural Cr.



LATE PLEISTOCENE
Recessional Till
Outwash Gravels
Early Ice Marginal Lake Deposit
Drumlinized (Transgressional) Till
Precambrian Belt Series Bedrock
TRUE N.
MAG. N
21°
KILOMETER
0 5 10 20
0 1 2
MILE
Pleistocene Meltwater Stream Channel
Bedrock Notch Cut by Ice-Marginal Stream
Kettle Lake
Kootenai River
Qal
Qog
Qlc1
Qt1
Qt2
Qos2
Qaf
PЄ
Tobacco
Sullivan
Pinkham Cr.
Cadette Cr.
Boulder Cr.
LAKE KOOCANUSA BRIDGE
A
A'

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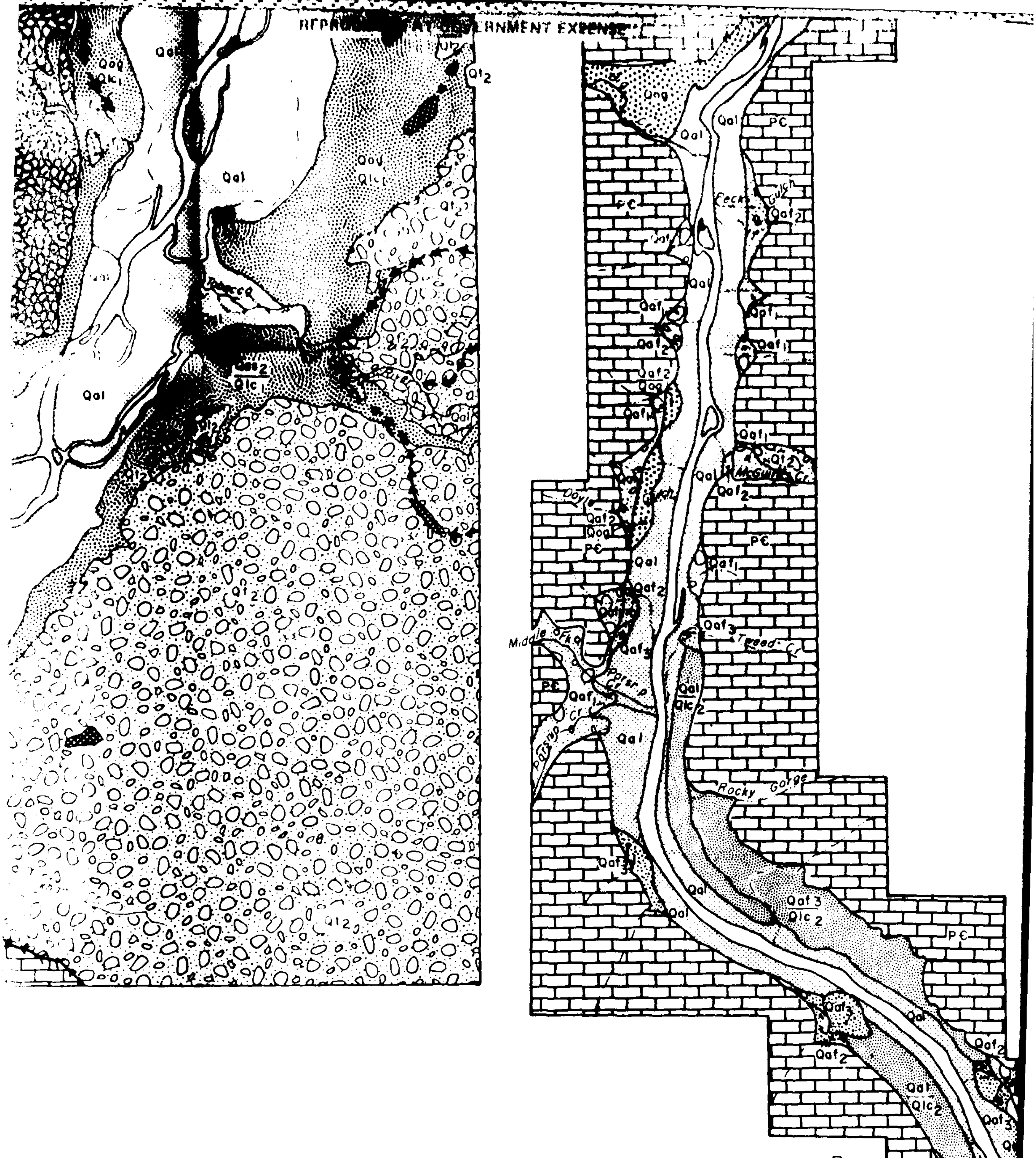

Qal
Qog
Qlc1
Qt2
PЄ
Peck Gulch
Qaf1
Qaf2
Qaf3
McGuire Cr.
Doyle Gulch
Middle Fork
Porter Cr.
Parsnip Cr.
Tweed Cr.
Rocky Gorge
Qlc2
B

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Qal
Qlc2
Qaf2
Qt2
Qaf3
PЄ
Warland Cr.
Horse Cr.
Peace Cr.
Souse Cr.
Sheep Cr.
LIBBY DAM
B'

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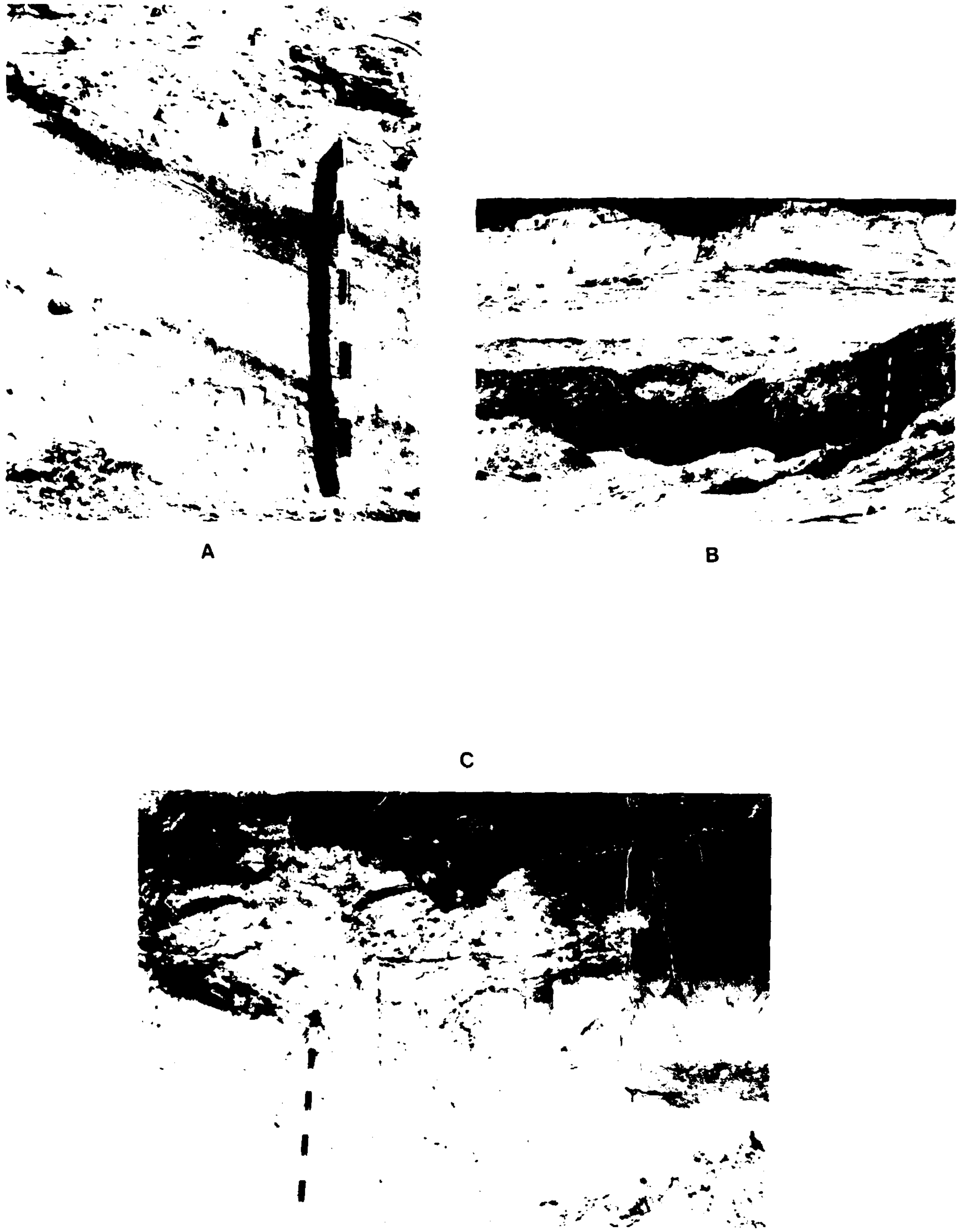

Figure 7-7. Photographs of, a. burned, buried surfaces at site 24LN1057; b. the meter scale rests on a buried soil horizon underlying site 24LN423; c. possible frost feature in top of Terrace 8 adjacent to site 24LN1057.

channel bar complexes. Not all portions of the floodplain were necessarily simultaneously active, so that some fluvial bars became inactive and briefly stabilized with vegetation until another phase of channel activation and braiding caused renewed flood-plain deposition. This is inferred from numerous unconformities and charcoal-mottled burned surfaces that characterize the fluvial sequences capping terraces 7 through 5 (Figure 7-7). As the Kootenai River continued to downcut and expose buried bedrock spurs and features, the channel became restricted in its ability to braid and the thalweg (i.e., valley profile) increasingly reflected bedrock control. As a result, major terrace expanses formed as channel marginal bars in eddys downstream of bedrock spurs, alluvial fans, and tight bends in the river. Fine-grained (silt and clay), vertical accretion flood basin deposits are virtually nonexistent, as are cut-off meander loops, scroll bars, and other geomorphic features associated with a meandering channel pattern.

Age

Age of the alluvium capping the various terraces postdates 11,200 years ago (see Kootenai Valley Terrace Formation section). A radiocarbon age of 11,730±410 years B.P. dates a burned floodplain surface buried 2 m below T7. A date of 8,170±100 years B.P. (Rice 1979; Munsell and Salo 1979) from below the modern floodplain indicates that the Kootenai River had reached its modern level prior to this time.

Aeolian Sands (Qas_1 and Qas_2)

Description

These consist of moderately to moderately well sorted, fine to medium, massive, brown, mottled strong brown, sands. Locally, the deposits exhibit strong bioturbation from tree-throw and rodent burrowing, contain buried soil horizons, and show evidence of impeded drainage sometime in the past, possibly related to frozen ground phenomena. The modern soil solum has developed in this unit.

Distribution and Expression

An earlier aeolian sand unit (Qas_1) is restricted to the northern margin of Kootenai Flats. Here, a series of prominent dunes exhibit 15-20 m of relief. A primary layer of Mt. Mazama volcanic ash outcrops on some dunes or is buried in swales between dunes, where it overlies a buried soil horizon (Figure 7-7).

A later aeolian sand (Qas_2) is distributed throughout the project area. This deposit forms the most extensive unit within Kootenai Flats, where it conformably overlies Qas_1 deposits. Qas_2 deposits also form dunes, but relief is subdued as compared with the earlier dunes. Outside Kootenai Flats, Qas_2 deposits form a nearly continuous, 1-2 m thick sand sheet that mantles earlier deposits.

to be related to the depositional environment, which may have been affected by seasonally frozen ground or permafrost covered by a thin active layer.

Age

These deposits formed after downcutting of the Kootenai River began after 11,500 years ago. Glass shard content of sediment samples (see Glass Shard Analysis section) from Qaf_3 deposits indicates a pre-Mazama (6,700 B.P.) age for all but the upper 30 or so centimeters. Depending upon localized climatic and topographic factors, some of these may have formed after 6,700 B.P.

Kootenai River Gravels and Sands (Qal)

As the Kootenai River readjusted postglacially and began downcutting through glacio-fluvio-lacustrine valley fill, it left caps of alluvium on the various terraces (T7-T1). Although the alluvium can be separated into subunits of decreasing age as the river approached its modern level, alluvium spanning the last 11,200 or so years is mapped as a single unit. Because minimum reservoir levels of 2,342 feet prohibited field inspection, description of sediments comprising terraces 1 through 4 are included in the Qal mapping unit.

Description

Many of the archaeological excavation units were dug into Qal sediments and the profiles from these pits provided the information for much of this discussion. At sites 24LN1058, 24LN1054, and 24LN385 the deposits are composed of moderately sorted, moderate to poorly bedded medium and fine sands. At sites 24LN1057 and 24LN1054 several weakly developed soils (A-C sequa) exhibiting ferric oxide coats on grains as a result of ground fires, occur in the lower part of the unit. A weakly developed bioturbated soil locally caps the deposit at sites 24LN1054, 24LN1057, and 24LN1058. A similar soil in a similar sedimentary sequence is found on T6 at site 24LN396 where the deposits show a subrounded to rounded faintly imbricated gravel fining upward to moderately sorted weakly bedded fine sands. Fewer than 40 percent of these gravels are partially coated with thin discontinuous coats (1 mm thick) of calcium carbonates and are interstitially filled with coarse sand.

Distribution and Expression

These gravels and sands cap terraces throughout the project area and fill stream cuts into older drift. Geomorphically, these terraces are expressed as mid-channel and channel marginal bars.

Depositional Environment

These flood-plain deposits formed as the Kootenai River downcut through earlier valley fill. During downcutting stages, the Kootenai River probably flowed through multiple, braiding channels between

quiescent water near the center of the lake basin. However, such inner valley fill was eroded during downcutting of the Kootenai River, resulting in preservation of more proximal facies nearer the valley margins. The only deviation from this pattern was noted along segments of the valley margin removed from the mouths of tributary canyons; in such localities (e.g., north of Peace Creek and north of Jackson Creek) the primary tephra couplet is interbedded with fine silt and silty clay deposits, reflecting a more distal position relative to points of sediment influx at tributary mouths.

Age

Based upon the stratigraphic position of the St. Helens J and Glacier Peak tephras, it is clear that deposition of Qaf_2 deposits initiated prior to 11,800 B.P. and continued for some time after 11,200 B.P.

Late Fan Deposits (Qaf_3)

Description

These deposits consist of an unstratified, poorly to moderately sorted pale brown to light yellowish brown, coarse silt to fine sand matrix supporting a variable but generally low percentage of angular to subangular gravel to boulder size clasts. The fine matrix is characterized by a complex reticulate pattern of 2-10 mm thick, strong brown, clay-rich laminae and it exhibits thixotropic properties when saturated.

Distribution and Expression

Geomorphic expression is as low gradient, thin, symmetrical fan shaped aprons capping terraces 8 through 5. It is probable that these deposits cap even lower terraces; however, these remained inundated for the duration of the field investigation. Such fans are most frequently located at the mouths of ephemeral drainages that debouche onto broad, flat river terraces, but they are not restricted to such areas. Qaf_3 deposits were not observed north of the vicinity of Big Creek, but are common along the remaining portion of the Kootenai River valley.

Depositional Environment

Generally poor sorting, the reticulate pattern of laminae (which at site 24LN656 were expressed as lobate-shaped flow structures), and the angularity of the matrix supported gravels may reflect short distance transport as a high viscosity mass flow. Although the controlling variables of this depositional environment are poorly understood, a few can be identified. Two properties indicate that saturation with water is an important factor. First, Qaf_3 deposits are entirely leached of carbonates, an uncommon occurrence in this landscape dominated by fresh, carbonate-rich drift deposits. Secondly, the ferric oxide-rich clayey laminae are not illuvial accumulations reflecting soil formation. Rather, mobilization and accumulation of ferric oxides and clays appears

Depositional Environment

Because the volcanic ash couplet provides a ubiquitous time stratigraphic marker throughout the southern one-third of the project area, facies relationships and the lateral transition to contemporaneous but distinct depositional environments are easily traced. A particularly informative locality in this regard is the erosional escarpment paralleling the reservoir embayment up the mouth of Five Mile Creek. Here is exposed the proximal end of Qaf_2 deposits which fill abandoned stream channels cut into underlying Qt_2 deposits. The bottom of one such channel is filled with cross-bedded, well sorted, very fine to coarse sands interbedded with the tephra couplet. The ash couplet here is separated by 45 cm of fluvial sand whereas all other exposures of the ash couplet in distal fans are separated by about 5 cm of sediment, indicating a ten times greater rate of deposition within the proximal fan portion as compared with the distal portion. About 20 m north of this exposure is another section showing the tephra couplet bedded within a thin, very fine fluvial sand that overlies a unit of stream reworked gravels cut into the underlying till. A few hundred meters down Five Mile Creek from this locality is another section showing the tephra couplet interbedded with ripple laminated, moderately well sorted fine sands that overlie well stratified stream gravels becoming increasingly clast supported in a distal direction. The ash couplet here is separated by less than 10 cm. A final section exposed along the westernmost edge of the Qat_2/Qlc_2 landform immediately north of the present mouth of Five Mile Creek shows the tephra couplet encased within a moderately well sorted sand lens which in turn is interbedded with a moderately sorted, clast supported, cobbly gravel. This gravel is overlain by a 1 m cap consisting of two poorly sorted, matrix supported cobbly debris flow units.

Most outcrops of the tephra couplet, which occur at the mouths of tributary canyons, indicate subaqueous (deltaic) deposition in a slow-moving or slackwater environment. South of the mouth of Cripple Horse Creek the primary tephra couplet outcrops in fluvial sands filling large interstitial voids between angular, coarse boulder blocks and cobble talus derived from adjacent bedrock slopes along the western margin of Cripple Horse Mountain (Cripple Horse 7.5 minute quadrangle, USGS). Near the mouth of Bristow Creek, the tephra couplet with its interbedding sands is separated for a lateral distance of a few meters by a discontinuous lens of subangular fan gravels interbedded with fluvial sands, indicating a brief surge in discharge and stream competence during the time interval between deposition of each member of the volcanic ash couplet.

The picture is one of an active landscape being modified as large seasonal peaks in surface water runoff reworked coarse unstratified drift from higher areas of the mountainous landscape. Streams emanating from major tributary canyons experienced rapid fluctuations in discharge, competence, and probably capacity, resulting in deposition of large volumes of deltaic sediments to the proglacial Lake Kootenai basin. Presumably, the most distal facies of these deltas would have been expressed as silt and clay beds or turbidites deposited in

Distribution and Expression

Generally, this mapping unit was not well exposed or easily differentiated. Remnants of these fan gravels can be found at the mouths of large tributary canyons above elevations of about 2,450 feet. Where the fan morphology is clear, the distal ends have been truncated by the Kootenai River and deeply incised by tributary stream channels. Younger fans (Qaf_2 or Qaf_3) generally form their apexes near the emergence of the tributary channel from the distal scarp. Qaf_1 deposits are more easily recognized along the central portion of the project area where the valley is narrowest and rocky. Here, the distal erosional scarps are more visible because subsequent deposits (Qlc_2 and Qaf_2) have been eroded.

Depositional Environment

Poor sorting, matrix support of clasts, and surface morphology indicate short transport distance and rapid deposition for these deposits. As the Kootenai Valley became ice free, paraglacial fan deposits (Ryder 1971), such as debris flows, accumulated at tributary confluences probably during maximum runoff periods. These deposits may represent the downslope and downvalley movement of the till veneer in the newly deglaciated environment.

Age

Because these deposits are graded to a higher base level than the T8 terrace they predate the younger lacustrine sediments (Qlc_2). At locality 12 (Figure 7-1) alluvial fan or debris flow deposits overlie a ground moraine indicating a postglacial age for the deposit.

Middle Fan Gravels (Qaf_2)

Description

A variable unit that at the proximal end is poorly sorted, weakly bedded, with subangular to rounded, nonstriated gravels and boulders, clast supported with a sandy interstitial matrix. Distally, Qaf_2 deposits are moderately to moderately well sorted, well stratified, clast supported open framework rounded gravels to ripple laminated sands. The sandy facies is interbedded with the uppermost Qlc_2 deposits.

Distribution and Expression

Middle fan deposits are best expressed along the southern one-third of the project area at the mouths of major tributary canyons. Within the narrowest portion of the middle segment of the Kootenai River valley Qaf_2 deposits become less frequent and diminished in size. North of Big Creek these deposits disappear entirely. Fan surfaces are dissected by stream gullies or in some instances have been masked by deposition of Qaf_3 deposits, so that overall fan morphology is not clearly expressed. Fan deposits appear to be relatively thin (10 m) and the gradient of fan surfaces appears to have been low.

Units and Reregulating Dam Project, File No. E-87-1-14, 10 feet contour interval, reproduced in Munsell and Salo 1979), aerial photographs, and field observations indicate that the T8 terrace can be traced south as far as Libby, and to the west, possibly as far as the vicinity of Troy, Montana. A conspicuous bluff just east of the city of Libby has been eroded into the side of the T8 terrace, as noted by Alden (1948, 1953) and others (Johns 1970; and Boettcher and Wilke 1978).

Depositional Environment

Sedimentary structures and textures combined with the rythmic sequence of beds indicate deposition in a slackwater environment. An upward coarsening sequence suggests change from lacustrine to fluvial conditions or that the clastic intake changed with respect to grain size, load, and yield. Presence of the Bouma sequence (divisions B, C, D, and E) reflects transport and deposition from density currents. At the mouths of major tributaries, such as Bristow and Five Mile Creeks, the tephra couplet is interbedded in alluvial fan and delta gravels and sands which are graded to the T8 terrace, suggesting that significant sediment influx occurred at tributary mouths.

Age

The date of initial lacustrine sedimentation is unknown; however, the age of the uppermost deposits is estimated from the occurrence of a primary tephra couplet discussed previously in Chapter 7. Because the lower St. Helens J ash postdates 11,800 B.P. and the Glacier Peak G ash predates 11,200 B.P. the ash couplet provides an approximate 11,500 B.P. time marker. Thus, deposition of Qlc_1 predated 11,500 B.P.

Alluvial Fan Gravels (Qaf_1, Qaf_2, and Qaf_3)

Three distinctive deposits of decreasing age were recognized in the project area. The two younger deposits exhibit alluvial fan morphology whereas the older unit is interbedded with or underlies glacio-lacustrine sediments (Qlc_2).

Older Fan Gravels (Qaf_1)

Description

Poorly sorted, nonbedded, matrix supported, angular to subrounded gravels and boulders form extensive deposits at the mouths of major tributary canyons. Usually, these deposits contain a low percentage of striated and grooved boulders derived from nearby till. Laterally, such deposits grade into Qt_2, and where the fan morphology has been strongly altered by erosion, Qt_2 and Qaf_1 may be undifferentiated.

Age

A radiocarbon age of 23,565±1,400 B.P. was obtained from charred, finely divided plant remains and plant pieces (probably bark) deposited in thinly laminated to massive, moderately well sorted lacustrine or fluvial sands that unconformably underlie Qog gravels at the mouth of Big Creek (Figure 7-6). These sands have not been observed in any other part of the project area. Qog clearly postdates 24,000 radiocarbon years B.P. Based on its high position in the landscape (T13 and T14) and relationship to other stratigraphic units in the project area Qog is older than the minimum limiting date of 11,700 B.P. for St. Helen's J tephra, but it must be younger than or contemporaneous with the later stages of Cordilleran ice retreat and decay after 15,000 B.P.

Younger Glaciolacustrine Deposits (Qlc_2)

Description

Moderately to moderately well sorted, thinly laminated, light yellowish brown to grayish brown clays, silts, and very fine sands occurring at elevations up to 2,465 feet comprise a glaciolacustrine deposit that postdates Qlc_1. These sediments form the core of the T8 terrace, which is unconformably overlain by fluvial deposits up to 2,480 feet elevation. The Qlc_2 sediments commonly display Bouma divisions B, C, D, and sometimes E in the upper 8.0-1.5 m of the deposit (Walker 1979). Because the reservoir level was never below 2,342 feet, thickness of the deposit is unmeasured. The deposit coarsens upward from alternating beds of silts, very fine sands, and clays to coarse silts and very fine sands which at several localities exhibit sharp crested oscillating ripple marks.

A primary tephra couplet consisting of St. Helens J overlain by Glacier Park G was found in the upper 1.5 m of the deposit. Laterally, the tephra couplet maintained a consistent elevation of about 2,460 feet, except at Peace Creek where the couplet occurs both at 2,460 feet and at 2,410 feet. At the mouths of major tributary canyons the tephra layers are interbedded with alluvial fan and deltaic sands and gravels (Qaf_2) that are graded to the level of T8 (Figure 7-3).

Distribution and Expression

These deposits can be traced from Libby Dam at the south to about 5 miles north of Ten Mile Creek. North of this point, which roughly coincides with the narrowest and rockiest stretch of the Kootenai River valley, the T8 terrace disappears and Qlc_2 sediments are no longer exposed along terrace edges. Related to this is the complete absence of the tephra couplet north of Ten Mile Creek.

Qlc_2 deposits and the tephra couplet outcrop at numerous localities and can be traced laterally for hundreds of meters along the southern third of the reservoir, from Ten Mile Creek to Libby Dam. Examination of detailed contour maps (US Army Corps of Engineers, Libby Additional

1

2

3

Figure 7-6. Photographs of sedimentary sequence at Locality 18, mouth of Big Creek. A radiocarbon date of 23,565±1400 was obtained from charred organic remains removed from the thin bed marked by the top of the meter scale in the lower left photo. The numbers in the upper left show the locations of the corresponding photographs.

Stratified Drift (Qog)

Description

Moderately sorted, moderately to well stratified deposits consisting of subrounded to rounded, nonstriated and nongrooved bouldery gravels with interbeds of moderately to well sorted, well bedded fine to coarse sands are exposed at elevations between 2,350 feet and 2,600 feet. The gravels are variably coated with thick (1-10 mm) accumulations of calcium carbonate and are supported within poorly sorted coarse sands partially cemented to form gravel clasts.

At the confluence of major streams the gravels are very poorly sorted, and contain a higher percentage of angular boulders some of which display grooves and striae. These boulders are probably derived from nearby ground moraines (Qt_1).

Distribution and Expression

The thickest and most prominent exposure of Qog occurs at the mouth of Big Creek where the gravels are found at elevations as high as 2,600 feet (T9 terrace) and are more than 20 m thick. However, similar (but unmapped) gravels at lower elevations (2,350-2,450 feet) at Bristow Creek, McGillivray camp ground, and Canyon Creek unconformably overlie basal till (Qt_1 or Qt_2) and overlie younger lacustrine sediments (Qlc_2). North of Pinkham Creek the gravels unconformably overlie older lacustrine deposits (Qlc_1).

Depositional Environment

Rounding, sorting, and bedding indicate fluvial deposition. Distribution and field relations suggest that these gravels represent outwash or kame terrace deposits during a time when the Kootenai River was free-flowing from the Rocky Mountain Trench into the Columbia River drainage. Along a prominent bluff adjacent to the west bank of the Kootenai River about a mile south of the U.S.-Canada border is an exposure of Qog showing unstratified and unsorted, matrix supported gravelly till (Qt_1 or Qt_2) grading over a lateral distance of 20 m into weakly stratified, clast supported gravels (Qog). In addition, the deposit shows large-scale convolution and load structures into underlying stratified sands which in turn overlie glaciolacustrine deposits (Qlc_1). The sedimentary structures and stratigraphic relationships here indicate that Qog gravels are at least partially derived from local till deposits.

At the mouth of Big Creek, the lower portion of Qog gravels are poorly sorted, weakly stratified, and deformed. With increasing elevation in the section, stratification becomes better expressed and sorting increases, indicating a decrease in sediment load to discharge ratio (Figure 7-6). These deposits, which form the expansive terrace at the mouth of Big Creek, may record high levels of meltwater stream discharge from the Big Creek drainage.

Distribution and Expression

These deposits occur north of the mouth of Pinkham Creek and are prominently exposed in the high erosional bluffs on both sides of the Kootenai River up to the United States-Canada border. Maximum elevation is between 2,550 and 2,600 feet, where these glaciolacustrine sediments are capped by gravels (Qog) and form flat terraces abutting recessional morainal drift (Qt_2). Prior to downcutting of the Kootenai and Tobacco Rivers, this deposit probably formed a nearly continuous fill, bounded on the east, west, and south by morainal debris and possibly ice. These boundaries are marked, respectively, by the moraine forming the west margin of Tobacco Plains, morainal debris along the lower east slopes of the Purcell Mountains, and by an inferred morainal or ice dam, somewhere between the mouth of Pinkham Creek and Boulder Creek.

Depositional Environment

Sedimentary structures and stratigraphic relations indicate that clays, silts, and sands were deposited in an ephemeral, quiescent ice marginal lake that experienced sudden influxes of sediment saturated water. This lake existed during temporary blockage of drainage down the Kootenai River valley, probably related to downwasting of glacial ice heavily laden with rock debris.

Convoluted bedding and clastic dikes may indicate loading and deformation while these lake sediments were still saturated with water and that a glaciofluvial episode eroded into the upper lake sediments and in many places deposited a conspicuous fluvial sand and gravel cap. This fluvial event(s) occurred during or after reestablishment of drainage down the Kootenai River valley.

These glaciolacustrine deposits were mapped by Alden (1953:151 and Plate 1) who assigned them to Glacial Lake Kootenai and correlated them with terrace deposits in the vicinity of Libby, Montana. However, these deposits (Qlc_1) (north of Pinkham Creek) predate and are separate from the prominently exposed glaciolacustrine deposits near Libby, Montana noted by various observers (Alden 1948, 1953; Johns 1970; Boettcher and Wilke 1978).

Age

Age of Qlc_1 deposits is unknown. However, they must be contemporaneous with deglaciation of the area, which may have occurred prior to 12,200 B.P. (Harrison 1976). Although Qlc_1 deposits have not been traced south of Pinkham Creek, their position high in the landscape (T9 to T12), their distinctive sedimentary properties, and their subjacent relationship to the more widespread Qog unit suggest that they stratigraphically underlie and therefore predate deposits (Qlc_2) containing St. Helen's J tephra, about 11,800 radiocarbon years old.

the Rocky Mountain Trench north of the U.S.-Canada border. The distal edge of this moraine is not arcuate; instead, its boundaries reflect control by the narrow Kootenai River gorge beginning near the mouth of Pinkham Creek and by the ice-scoured northern toe of the Salish Mountains north of the Pinkham Creek drainage.

South of Pinkham Creek Qt_2 deposits fill Kootenai River tributary canyons or thinly mantle bedrock slopes. Topography is hummocky and occasionally interspersed with low gradient, bench-like expanses. The kettle and kame topography has been somewhat subdued by subsequent erosion and deposition, so that the small kettles retain water only on a seasonal basis. Qt_2 deposits are most clearly exposed in cuts along SR 37 above 2,500 feet elevation.

Depositional Environment

The kettle and kame topography, which in the Tobacco Plains vicinity appears to overlie drumlinized till (Qt_1) but underlie outwash gravels (Qog), indicates that Qt_2 was deposited during ice stagnation and disintegration. Within the narrow tributary canyons, ice decay was accompanied by mass wasting of the fresh glacial debris possibly resulting in mixing of tills.

Age

These deposits record recession and disintegration of Cordilleran ice sometime between 12,000 and 15,000 years ago. Such deposits within the Kootenai River valley have not been directly dated, but can be inferred to predate the older subset of St. Helen's J tephra at 11,800 B.P. (Mullineaux et al. 1975). A date of 12,200 B.P. from the lower Elk River valley (Harrison 1976) suggests that at least partial ice-free conditions existed by this time, and it is possible that deglaciation occurred even earlier (c.f., Ferguson and Osborn 1981, 1982; Clague 1982).

Earlier Glaciolacustrine Deposits (Qlc_1)

Description

Moderately well sorted to well sorted, massive to horizontally laminated light yellowish brown clays, silts, and very fine sands occur between about 2,400 and 2,600 feet. The rythmic bed sequence may correspond to Bouma divisions B, C, and D (Walker 1979). Faults, folds, and convolution structures representing loading and possibly ice contact are common. At some localities, fractured surfaces exhibit a hackly texture or slickensides. At the mouth of Tobacco River, clastic dikes from water saturated glaciolacustrine beds appear to have been injected through hydraulic pressure into the overlying fluvial sands. Near the mouth of Dodge Creek the unit overlies an undifferentiated till.

and the Forest Development Road. Because most basal till deposits outcrop along steep reservoir-marginal slopes, winnowing of the fine matrix and colluviation tend to mask and homogenize what may be separate and distinct till units or possibly interbedded fluvial gravels. Absence of drumlins between the Tobacco River and Libby, Montana can be explained by: (1) the narrow and steep canyon walls providing an unfavorable site for drumlin formation and preservation; (2) rugged terrain; and (3) extensive post-glacial erosion of drift fill.

Depositional Environment

Drumlinized till and ground moraines were deposited as ice advanced southeast along the Rocky Mountain Trench to the Flathead Lake vicinity and south through the Kootenai River valley. Preservation of the drumlin field north of Tobacco River suggests that the ice suddenly stopped advancing and rapidly decayed without significant surges or readvances.

Age

Age of the last late Pleistocene Cordilleran ice advance has been dated between 18,000 and 15,000 years B.P. by Fulton (1971) and Clague (1981). The Rocky Mountain Trench may have been ice free as far north as Elk River in British Columbia by 12,200 B.P. or earlier (Harrison 1976; Clague 1982).

Unstratified Drift (Qt_2)

Description

Very poorly sorted, mostly nonstratified, subangular to subrounded gravels and boulders supported in a light gray sandy silt matrix. Striated and grooved facets on clasts predominate; most coarse clasts are coated with a variable thickness of calcium carbonate sometimes in excess of 10 mm. A component of this mapping unit is the occurrence of interbeds of a moderately to moderately well sorted, massive to moderately bedded, light gray to brown, silt loam to very fine sandy loam. A distinguishing property of the sediment is that it is thixotropic at field capacity or higher moisture contents. Judging from road cut exposures, Qt_2 deposits are on the order of 10s of meters thick.

Distribution and Expression

These deposits are mapped throughout the project area between 2,500 feet to approximately 3,000 feet. North of Pinkham Creek Qt_2 is expressed as a prominent moraine as noted by Alden (1953:Plate 1). Kettle and kame topography is well expressed, with many of the kettles retaining lakes in the Tobacco Plains. Aerial photographs reveal numerous meltwater channels cut into this moraine and the adjacent terraces (Qog); these channels are continuous with and exhibit similar morphology to features described by Clague (1975c) for adjacent areas of

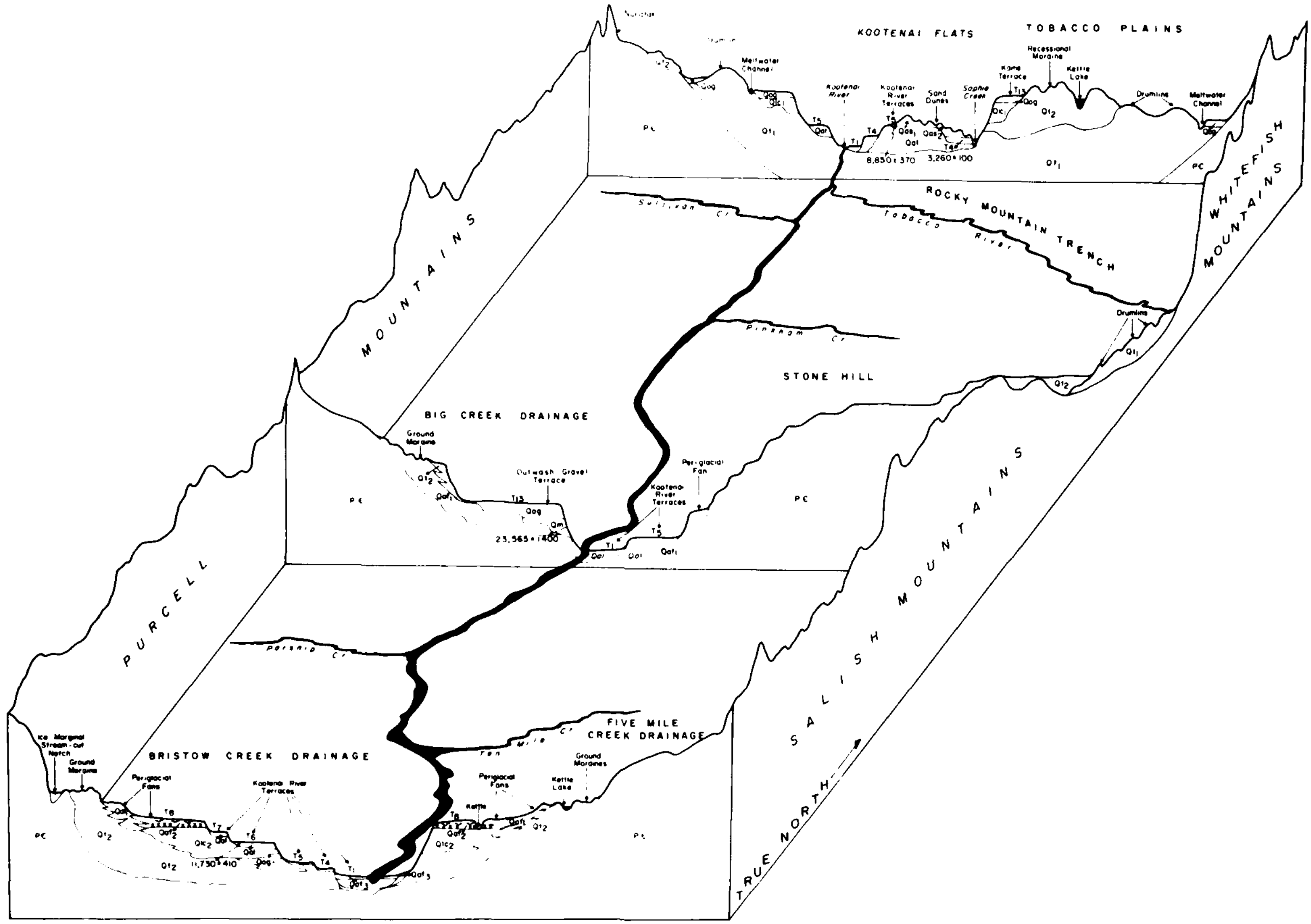

Figure 7-5. Fence diagram showing the approximate relationship of mapping units (Figure 7-4) and geomorphic features within the project area.

Depositional Environment

The Kootenai Flats dune field lies immediately leeward of an expansive alluvial plain eroded into late Pleistocene drift (Qt_1, Qt_2, Qlc_1, and Qog). Prior to reservoir innundation, multiple Kootenai River channels in this plain braided through active channel bar complexes during episodes of seasonally high discharge. During intervening periods of low discharge, the newly exposed bar surfaces were subject to wind erosion. Downstream of Kootenai Flats the river leaves the broad Rocky Mountain Trench and enters the steep and narrow Kootenai River valley. From this point on, the Qas_2 deposits are expressed only as a thin aeolian sand sheet.

A distinctive characteristic of the aeolian sheet is the presence of features that may have an origin related to frozen ground at sometime in the past. These features generally occur in clusters, where they intrude into underlying Qaf_2 and Qal (T7-5) deposits. They are most prominent atop Qaf_2 (Terrace 8) deposits and become more subdued and less frequent on successively lower terraces down to T5. Where terraces lower than T5 have been examined outside of the reservoir, the features were not observed.

In sectional views the features form prominent basins on the order of a meter or less wide and a meter or less deep (Figure 7-7). Sides are nearly straight and vertical and bottoms are flat, although irregular or wedge shapes also occur. Characteristically, these features are filled with aeolian sands that are identical in texture and color to the sands above and outside of these features. These sands are mottled with ferric oxide segregations indicating saturation from a high water table, although today these sediments are well drained. Interbedded within the sandy fill of the features and also occurring outside of them are numerous strong brown, clay-rich laminae arranged in either a complex reticulate pattern or a series of subhorizontal, parallel laminae that in both cases become sequentially thinner upward in the profile. Similar structures were observed in Qaf_3 deposits. This laminated zone is continuous over lateral distances of hundreds of meters, even where concentrations of frost features are absent.

Such features bear strong resemblances to peri-glacial phenomena termed drop or pocket involutions (Washburn 1980). Although the origin of involutions is poorly understood, there is some evidence that they may be related to permafrost or seasonally frozen ground. Mottling of the sandy fill indicates periods of water saturation characterized by a weak reducing chemical environment that alternated with periods characterized by strong oxidation, causing ferric oxide aggregations. In all observed cases the sandy matrix and clay-rich lamellae are entirely leached of carbonates. Sediments immediately underlying frost features are high in carbonates as measured by reaction to dilute HCl.

These features are nearly identical in shape and internal structure to ones previously noted in glaciolacustrine and dune deposits in the Purcell Trench south of Bonner's Ferry, Idaho approximately 95 km to the west (Mierendorf and Cochran 1984). Involutions have been reported east

of the Continental Divide in northwestern Montana (Schaefer 1949), but do not strongly resemble the features noted here. At present the origin of these features remains problematic until more thorough study is possible and until other processes (e.g., thermokarst) are considered.

Age

Exposure of newly deposited drift immediately following deglaciation may have initiated aeolian reworking of sediments, possibly as early as 12,200 or more years ago. However, along the Kootenai River valley, aeolian sands containing possible frost features clearly overlie the volcanic ash couplet that postdates 11,200 B.P. In the Kootenai Flats vicinity, primary Mazama ash outcrops at the crest of some prominent dunes, indicating substantial dune building prior to 6,700 B.P. A buried soil from a swale adjacent to one such dune provided a date of 8,850±370 radiocarbon years B.P. A somewhat more subdued series of dunes in Kootenai Flats lacks any primary volcanic ash layers or paleosols, suggesting continued dune building during later Holocene times. A radiocarbon sample on bone from archaeological site 24LN677, atop one such dune, dated 3,260±100 B.P. Finally, glass shard analysis of sediment samples from the aeolian sheet sands capping terraces 8 through 5 indicates that most deposition (and formation of the possible frost features) predates 6,700 B.P., but that aeolian deposition continued well after this date.

APPENDIX H

RADIOCARBON DATES

by
Robert R. Mierendorf

This appendix provides technical information about each radiocarbon sample submitted for dating as part of the Libby Archaeological Project. These radiocarbon dates have not been published previously. Radiocarbon ages were calculated using the Libby half-life of 5568 years.

Lab Number	Weight of Counted C	C-14 Age	C-13 Adjusted Radiocarbon Age
Beta-4989	--	3,170±100	3,260±100
Beta-4990	0.28 g	23,550±1,400	23,565±1,400
Beta-5227	0.20 g	8,820±370	8,850±370
Beta-5228	0.25 g	11,590±410	11,730±410

Beta-4989

The sample consisted of 230 g of burned bone collected from a single feature at archaeological site 24LN677. The sampling location is NW 1/4 of NE 1/4 of SE 1/4 and SW 1/4 of NE 1/4 of SE 1/4 of Section 7, T. 37N, R. 27W, Rexford 7.5' quadrangle. The sample was removed from the surface down to about 30 cm below surface at the top of a prominent sand dune at about 2,400 ft elevation in Kootenai Flats. Soil development across the top of the dune is weak, and exhibits a brown, moderately well-sorted, loamy fine sand, cambic B horizon. Portions of the O and A horizons have been removed by reservoir related erosion. The date is considered reliable for both archaeological and geological interpretations.

Beta-4990

The collected sample consisted of about 10 g of finely divided and charred plant remains; after pretreatment, 0.28 g of datable carbon remained. Due to its small size, the sample was counted for an extended period of time. The sampling location is NE 1/4 of NW 1/4 of SW 1/4 of Section 2, T. 34N, R. 29W, Inch Mountain 7.5' quadrangle. The sample was removed from a section exposed near the mouth of Big Creek, at approximately 2,465 ft elevation.

The sample was removed from a pale brown, moderately well-sorted, weakly horizontal laminated to massive, very fine sand unit of fluvial origin. This unit is about 15 cm thick and is about 4.4 m below the top of the erosional bluff. It is overlain by convoluted and faulted fluvial sands which are in turn overlain by a thick unit of stratified,

clast supported outwash gravels. The date is considered reliable and agrees well with field relations, which suggested an Olympia Interglacial age for the unit. The sample is not associated with cultural remains.

Beta-5227

After pretreatment, the approximately 2 g of charred, finely divided plant remains was reduced to 0.20 g of carbon. Due to its small size, the sample was counted for an extended period of time. The sampling location is SE 1/4 of NW 1/4 of NW 1/4 of Section 8, T. 37N, R. 27W, Rexford 7.5' quadrangle.

The sample was removed from a swale between dunes, at an approximate elevation of 2,350 ft, at the northern margin of Kootenai Flats. The plant remains occurred within the top 10 cm of a moderately developed A horizon buried 2 m below the modern surface; the soil consisted of a dark yellowish brown, moderately well-sorted, loamy fine sand. Unconformably overlying this soil was a thin layer of primary Mazama volcanic ash which was in turn overlain by more than a meter of redeposited ash. The date is considered reliable; it is not associated with cultural remains.

Beta-5228

After pretreatment, the approximately 2 g of charred, finely divided plant remains was reduced to 0.25 g of carbon. The sample was thus counted for an extended period of time. The sampling location is SE 1/4 of NW 1/4 of NE 1/4 and SW 1/4 of NW 1/4 of NE 1/4 of Section 14, Ural 7.5' quadrangle.

The sample was removed from a section exposed near the mouth of Bristow Creek, at an elevation of approximately 2,400 ft. The plant remains were collected from a thin lens of reddish, heat oxidized sediment approximately 4.7 m below the surface. The surface represents an ephemeral period of stability during flood plain deposition of the Kootenai River shortly after cessation of glaciolacustrine conditions. The date is somewhat older than anticipated; however, the minimum limiting date at one standard deviation is considered acceptable.

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